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Using Behavioral Economics to Reduce Low-Value Care Among Older Adults
A Cluster Randomized Clinical Trial

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IMPORTANCE Use of low-value care is common among older adults. It is unclear how to best engage clinicians and older patients to decrease use of low-value services.

OBJECTIVE To test whether the Committing to Choose Wisely behavioral economic intervention could engage primary care clinicians and older patients to reduce low-value care.

DESIGN, SETTING, AND PARTICIPANTS Stepped-wedge cluster randomized clinical trial conducted at 8 primary care clinics of an academic health system and a private group practice between December 12, 2017, and September 4, 2019. Participants were primary care clinicians and older adult patients who had diabetes, insomnia, or anxiety or were eligible for prostate cancer screening. Data analysis was performed from October 2019 to November 2023.

INTERVENTION Clinicians were invited to commit in writing to Choosing Wisely recommendations for older patients to avoid use of hypoglycemic medications to achieve tight glycemic control, sedative-hypnotic medications for insomnia or anxiety, and prostate-specific antigen tests to screen for prostate cancer. Committed clinicians had their photographs displayed on clinic posters and received weekly emails with alternatives to these low-value services. Educational handouts were mailed to applicable patients before scheduled visits and available at the point of care.

MAIN OUTCOMES AND MEASURES Patient-months with a low-value service across conditions (primary outcome) and separately for each condition (secondary outcomes). For patients with diabetes, or insomnia or anxiety, secondary outcomes were patient-months in which targeted medications were decreased or stopped (ie, deintensified).

RESULTS The study included 81 primary care clinicians and 8030 older adult patients (mean [SD] age, 75.1 [7.2] years; 4076 men [50.8%] and 3954 women [49.2%]). Across conditions, a low-value service was used in 7627 of the 37 116 control patient-months (20.5%) and 7416 of the 46 381 intervention patient-months (16.0%) (adjusted odds ratio, 0.79; 95% CI, 0.65-0.97). For each individual condition, there were no significant differences between the control and intervention periods in the odds of patient-months with a low-value service. The intervention increased the odds of deintensification of hypoglycemic medications for diabetes (adjusted odds ratio, 1.85; 95% CI, 1.06-3.24) but not sedative-hypnotic medications for insomnia or anxiety.

CONCLUSIONS AND RELEVANCE In this stepped-wedge cluster randomized clinical trial, the Committing to Choose Wisely behavioral economic intervention reduced low-value care across 3 common clinical situations and increased deintensification of hypoglycemic medications for diabetes. Use of scalable interventions that nudge patients and clinicians to achieve greater value while preserving autonomy in decision-making should be explored more broadly.

TRIAL REGISTRATION ClinicalTrials.gov Identifier: NCT03411525

Visual Abstract

Supplemental content

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Low-value services constitute health care that does not improve patient outcomes and can cause unnecessary harms.[1] In the US, delivery of low-value services is common[2,3] and costly,[4,5] particularly among older adults.[6-8] One evidence-based effort to raise awareness of low-value services is the Choosing Wisely campaign, which started in the US in 2012 and has spread worldwide.[9] However, awareness of evidence is often insufficient to change clinical decisions.[10,11] Furthermore, getting clinicians to stop an action may require different approaches than getting clinicians to initiate a practice.[12-14] Therefore, complementary strategies are needed to target factors that drive decisions to use low-value services and patient desires to receive them.[15]

For example, even when clinicians are aware that specific services may not improve outcomes and could cause harm, the need to make decisions quickly during a busy and cognitively demanding clinical encounter can prompt reflexive decisions to order tests or treatments.[16] Rushed decisions about low-value services can also be more susceptible to patient demands and perceived social norms that more care is better.[17] Furthermore, a busy clinic encounter may not allow time to discuss scaling back tests or treatments.[18]

Three promising, complementary solutions to this problem can be found in the field of behavioral economics: supporting deliberative thinking,[19] using nonbinding precommitment,[20] and providing social information about what peers decided to do.[21] First, quick decisions often dominate during busy encounters when clinicians are multitasking and are likely to result in more decisions that diverge from evidence, whereas deliberative thinking may be more common before encounters when clinicians review patient data to form preliminary management plans and is more likely to produce decisions that align with evidence.[22] Therefore, if clinicians initiated more decision-making before encounters, they might be more likely to adhere to evidence-based recommendations to avoid low-value services. Second, although initiating clinical decisions before encounters could facilitate avoidance of low-value services, clinicians often need more data from a patient before making their final decision, and patients also want to be involved in the decision process. To overcome these challenges, before encounters, clinicians could be asked to commit their future selves (ie, precommit) to an intended course of action when presented with a particular clinical situation.[20,23-25] Adherence to such commitments could be fostered by point-of-care reminders and patient-facing materials to optimize conversations about low-value services. Third, prevailing social norms can influence a range of behaviors.[26-32] Thus, signaling social norms of peer clinicians to avoid use of low-value services could further facilitate achievement of this outcome. The objective of this study was to test whether a scalable behavioral economic intervention that supported deliberative thinking, solicited nonbinding precommitment, and provided information about social norms could reduce low-value care.

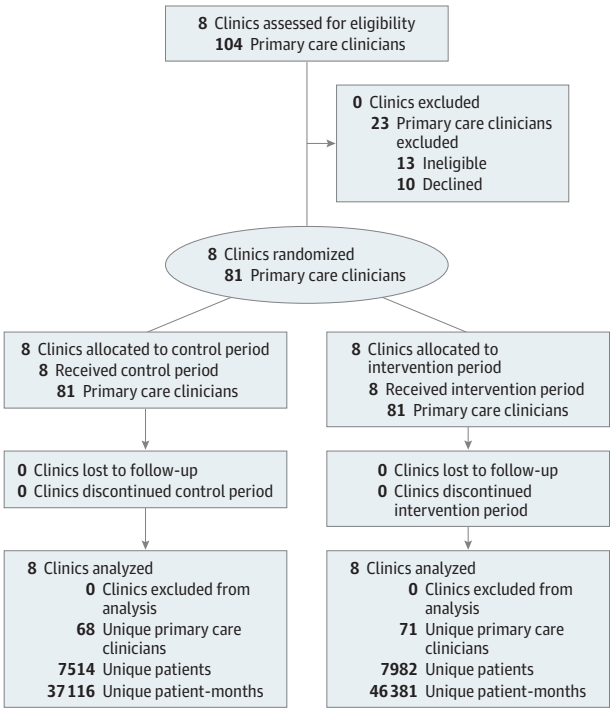
Key Points

Question How can use of low-value care be decreased among older adults while preserving autonomy in decision-making?

Findings In this stepped-wedge cluster randomized clinical trial including 81 primary care clinicians and 8030 older adults, a behavioral economic intervention that engaged primary care clinicians and older patients reduced low-value care across 3 common clinical situations and increased deintensification of hypoglycemic medications for diabetes.

Meaning Use of scalable interventions that nudge patients and clinicians to achieve greater value while preserving autonomy in decision-making should be explored more broadly.

Figure 1. CONSORT Flow Diagram



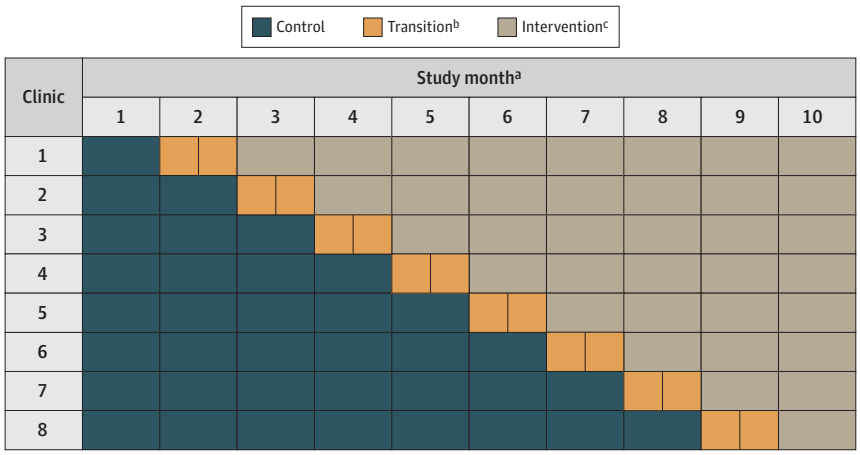
Methods

Study Design and Recruitment

We conducted this study between December 12, 2017, and September 4, 2019, in 8 primary care clinics of IHA, a private multispecialty group practice, and Michigan Medicine, the health system of the University of Michigan (trial protocol in Supplement 1). We used a stepped-wedge cluster randomized clinical trial design (**Figure 1**)[33,34] because all clinics could receive the intervention, and implementing the intervention in 1 clinic per month was more feasible than simultaneous implementation in multiple clinics as in a parallel-design cluster randomized clinical trial.

Clinics were selected in collaboration with leaders of each health system to maximize the number of eligible clinicians and applicable patients. All clinics that were invited agreed to participate. Recruitment and the intervention were rolled out to a new clinic each month in a randomly assigned order determined by the study statistician (H.M.K.). Within each clinic,

Figure 2. Stepped-Wedge Cluster Design



[a] The control, transition, and intervention periods followed the approximate schedule shown in the figure with the actual time from the start of the control period (December 15, 2017) to the end of the intervention period (November 1, 2018), spanning roughly 11 months due to scheduling constraints (eg, for recruitment meetings) in each clinic.

[b] Data for the months of the recruitment and precommitment processes (ie, the transition months) in each clinic were excluded from analyses because clinicians' behavior could be influenced by (1) prerecruitment knowledge that study recruitment would be starting soon and (2) postcommitment knowledge that the intervention would be starting soon.[34,35] The transition period commenced when the clinic's medical director was notified that their clinic would be next in the randomly assigned order for recruitment and the intervention. The vertical line in the boxes for these months indicates the approximate time of the recruitment and precommitment processes in each respective clinic.

[c] Each clinic (cluster) received 1 to 8 months of the intervention.

the physicians, nurse practitioners, and physician assistants were invited to participate. Clinicians were excluded if they did not anticipate working in the clinic for the duration of the study. Approximately 2 weeks before each clinic's intervention period, a study investigator (J.T.K.) visited the clinic to give a presentation about the study and invite participation. Of the 91 clinicians who were invited, 81 provided written informed consent to participate (**Figure 2**).[34,35] The study was approved by the University of Michigan Medical School Institutional Review Board.

Intervention

To promote deliberative thinking about low-value services, clinicians were asked to make a written commitment (eFigure 1 in Supplement 2) to follow 3 Choosing Wisely recommendations: (1) avoid using medications other than metformin to achieve a hemoglobin A_{1c} (HbA_{1c}) level less than 7.0% in most older adults with diabetes; (2) do not use benzodiazepines or sedative-hypnotics in older adults as the first choice for insomnia, agitation, or anxiety; and (3) do not routinely perform prostate-specific antigen (PSA)-based screening for prostate cancer in older men. These recommendations were selected because they focused on primary care services that are common in the US,[36-38] involved clinician and patient input in decision-making, and represented local opportunities for improvement based on administrative data and feedback from health system leaders.

Before the start of the study, these recommendations were modified slightly based on feedback from clinicians and leaders in each health system. Specifically, the HbA_{1c} threshold in the American Geriatrics Society (AGS)[39] diabetes recommendation was changed from 7.5% to 7.0% to better align with the health systems' existing quality measures. The American College of Preventive Medicine[40] recommendation against PSA testing to screen for prostate cancer was narrowed to focus on men age 75 years and older due to a newer recommendation from the US Preventive Services Task Force for shared decision-making around PSA testing for men aged 55 to 69 years[41] and because no professional guidelines recommend PSA screening after age 75 years.[42] The AGS recommendation around overuse of benzodiazepines and sedative-hypnotics[39] was modified to focus on just insomnia and anxiety to better align with the availability of administrative data.

Clinicians were asked to make this written commitment (eFigure 1 in Supplement 2) immediately after a brief presentation about the 3 Choosing Wisely recommendations and written informed consent. To remind clinicians of their commitment and signal social norms to avoid use of low-value services, photographs of committed clinicians appeared on posters in public waiting areas and examination rooms (example in eFigure 2 in Supplement 2). To support point-of-care deliberative thinking and adherence to written commitments, committed clinicians' scheduled patients for whom any of the 3 recommendations might apply were identified in administrative data (see Study Cohorts) and in advance of their appointment were mailed an applicable Consumer Reports[43] Choosing Wisely patient education handout (eFigures 3-5 in Supplement 2) along with brief information about the study. These mailed handouts were also available to clinicians and patients at the point of care. To further support point-of-care deliberative thinking and adherence to written commitments, committed clinicians received a weekly email with strategies to avoid use of low-value services during patient encounters (eFigures 6-9 in Supplement 2). All intervention components contin-

ued throughout each clinic's intervention period. Clinicians who consented to study participation but chose not to make the written commitment received no further intervention.

Study Cohorts

The patient cohorts for mailing of handouts and data analysis were defined using administrative data and diagnostic codes assigned to any encounter in the 12 months before the start of the control period (eTable 1 in Supplement 2). For the diabetes cohort, inclusion criteria were being 65 years or older and having an *International Classification of Diseases, Ninth Revision (ICD-9)* or *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10)* code for type 2 diabetes. For the insomnia/anxiety cohort, inclusion criteria were being 65 years or older and having an *ICD-9* or *ICD-10* code for insomnia or anxiety. For the prostate cancer screening cohort, inclusion criteria were being male and 75 years or older, and the exclusion criterion was having an *ICD-9* or *ICD-10* code for prostate cancer.

Outcomes

The primary outcome was patient-months with low-value care across the 3 patient cohorts as defined in the 3 Choosing Wisely guidelines. We chose patient-months of low-value care as the main outcome measure because use of low-value care can be dynamic over time for individual patients, particularly for management of chronic conditions. Secondary outcomes were within-cohort patient-months with low-value care and, for the diabetes and insomnia/anxiety cohorts, patient-months with deintensification and intensification of the targeted medications. Outcome data were collected by trained medical record abstracters who had access to the full electronic health records (EHRs) and were blinded to the control and intervention periods.

Diabetes Cohort

Low-value care was defined as a patient-month in which a hypoglycemic medication (ie, any medication for diabetes other than metformin; eTable 1 in Supplement 2) was continued at the same dose, newly started, or increased after an HbA_{1c} level less than 7.0%. If a hypoglycemic medication was decreased or stopped after an HbA_{1c} level less than 7.0% but another hypoglycemic medication was started or increased, this was considered a substitution and classified as low-value care. Patient-months without any preceding HbA_{1c} value were excluded from analyses.

Deintensification was defined as a patient-month in which a hypoglycemic medication was decreased or stopped after an HbA_{1c} level less than 7.0%, without a start or increase of a hypoglycemic medication in the same patient-month. Patient-months were considered eligible for deintensification whenever the most recent HbA_{1c} level was less than 7.0% and the patient was receiving a hypoglycemic medication that had not been deintensified. When deintensification occurred, that and all subsequent patient-months were considered ineligible for deintensification until another HbA_{1c} level less than 7.0% or the start or increase of a hypoglycemic medication.

Intensification was defined as a patient-month in which a hypoglycemic medication was started or increased after an HbA_{1c} level was less than 7.0%. All patient-months in which the most recent HbA_{1c} level was less than 7.0% were considered eligible for intensification.

Insomnia/Anxiety Cohort

Low-value care was defined as a patient month in which a patient was receiving a benzodiazepine or sedative-hypnotic medication (eTable 1 in Supplement 2). Deintensification was defined as a dose decrease or stoppage of a benzodiazepine or sedative-hypnotic medication without a dose increase or start of a similar medication. Intensification was defined as a dose increase or start of a benzodiazepine or sedative-hypnotic medication without a dose decrease or stoppage of another similar medication.

Prostate Cancer Screening Cohort

Low-value care was defined as a patient-month in which a patient had a screening PSA test. Whether a PSA test was screening or diagnostic (ie, ordered to evaluate symptoms) was determined by the blinded medical record abstracters using criteria developed by research team clinicians (J.T.K., E.A.K.). When a medical record abstracter was unable to determine whether a PSA test should be classified as a screening or diagnostic test, the classification was made by a research team clinician. All patient-months were considered eligible for low-value care, but once a patient had a diagnostic PSA test, that and all subsequent patient-months were excluded from analyses.

Statistical Analysis

Patient demographic characteristics were summarized for each cohort and health system. Because the composition of the diabetes and prostate cancer screening cohorts could change over time as patients met or did not meet inclusion criteria for analyses, patient characteristics were also summarized separately for the control and intervention periods.

To examine effects of the intervention on the primary outcome of patient-months with low-value care across the 3 cohorts, we fit a generalized linear mixed-effects model with logit link in which the dependent variable was patient-months with low-value care. We used a mixed-effects model to assess, across and within the 3 study cohorts, participant-specific differences in the odds of receipt of low-value care during intervention months compared to control months, rather than population-based differences.[44] The model included clinics as fixed effects and patients as random intercepts to account for correlation of longitudinal data within patients. Additional independent variables included patient cohort, age, gender, race and ethnicity (based on EHR data),[45] and time in months since study initiation to account for secular trends. The primary predictor variable was the binary time-dependent indicator for an intervention month. The prespecified study protocol called for inclusion of data from clinician surveys in models, but these data were not ultimately used to maximize study power in the setting of incomplete collection of clinician survey data.

Secondary analyses compared the proportion of patient-months with low-value care separately for each of the 3 study cohorts, as well as the proportion of patient-months with deintensification and intensification separately for the diabetes and

insomnia/anxiety cohorts. For secondary analyses, we fit similar separate models for each of the 3 study cohorts in which the dependent variable was low-value patient-months or, for the diabetes and insomnia/anxiety cohorts, patient-months with deintensification and intensification. To examine whether intervention effects differed over time, in exploratory analyses we added to the models an interaction term of intervention period by months since study start.

We conducted 3 sensitivity analyses for the diabetes cohort to evaluate the robustness of findings to prespecified analytic decisions. In the first, an HbA_{1c} level of 7.5% was used as the threshold for outcomes. In the second, an HbA_{1c} level of 7.0% was used, and patient-months without a preceding HbA_{1c} value were included and classified as not having low-value care. In the third, demographic characteristics were omitted as independent variables in the model.

We designed the study to have greater than 80% power to detect with .05-level 2-sided tests a reduction in patients-months with low-value care from 20.0% to 15.3% for diabetes, 15.0% to 10.7% for insomnia and anxiety, and 3.0% to 1.0% for prostate cancer screening, with an average of 11 clinicians in each of the 8 clinics and .05 within-clinician correlation. Analyses were conducted using Stata, version 16.0 (StataCorp LLC). Reporting followed the Consolidated Standards of Reporting Trials Extension (CONSORT Extension) reporting guideline for stepped-wedge cluster randomized clinical trials.

Results

Patient Characteristics

Of the 81 clinicians who participated, all made a written commitment to following the 3 Choosing Wisely recommendations, and 72 had applicable encounters during the study period. For the 8030 patients that composed the 3 cohorts, the mean (SD) age was 75.1 (7.2) years; 4076 (50.8%) were men and 3954 (49.2%) were women. For the diabetes cohort, there were 2680 patients, and the mean age and percentage of patients receiving any hypoglycemic medication at baseline (regardless of whether this was classified as low-value care) differed across the 2 health systems (**Table 1**). For the insomnia/anxiety cohort, there were 4226 patients, and the mean age and percentage of patients who were taking a benzodiazepine or sedative-hypnotic medication at baseline differed across the 2 health systems. For the prostate cancer screening cohort, there were 2342 patients, and the mean age differed across the 2 health systems. For all 3 cohorts, the percentages of patients in racial and ethnic groups differed across the 2 health systems.

Low-Value Care

Across the 3 patient cohorts, we observed low-value care in 7627 of the 37 116 control patient-months (20.5%) and 7416 of the 46 381 intervention patient-months (16.0%) (**Table 2** and **Figure 3**[46]). Overall, 554 patients in the diabetes cohort (20.7%), 1362 patients in the insomnia/anxiety cohort (32.2%), and 143 patients in the prostate cancer screening cohort (6.1%) received low-value care.

Across cohorts, the adjusted odds of patient-months with low-value care were lower in the intervention period compared to the control period (adjusted odds ratio [aOR], 0.79; 95% CI, 0.65-0.97). In an exploratory analysis (eTable 2 in Supplement 2), the intervention was less effective over time (aOR for the intervention by time interaction, 1.06; 95% CI, 1.01-1.12).

For each patient cohort, the point estimate for the aOR was similar to the pooled estimate, but there were no statistically significant differences between the control and intervention periods in the odds of patient-months with low-value care (Table 2; eFigures 10-12 in Supplement 2). In exploratory analyses (eTable 2 in Supplement 2), the intervention was less effective over time for the insomnia/anxiety cohort (aOR for the intervention by time interaction, 1.22; 95% CI, 1.11-1.33) but not for the diabetes or prostate cancer screening cohorts.

Medication Deintensification and Intensification

In the diabetes cohort, the percentage of patient-months with deintensification was slightly higher during control months (90 of 1611 [5.6%]) compared to intervention months (152 of 2791 [5.4%]). However, in our data we observed a secular trend toward less deintensification over the study period (eFigure 13 in Supplement 2). In multivariable analyses that adjusted for this secular trend (Table 2), the odds of deintensification of hypoglycemic medications were higher during intervention patient-months than control patient-months (aOR, 1.85; 95% CI, 1.06-3.24). For the insomnia/anxiety cohort, medication deintensification did not differ between the intervention and control periods (Table 2; eFigure 14 in Supplement 2). For both the diabetes and insomnia/anxiety cohorts, there were no significant differences in medication intensification between the intervention and control periods (Table 2; eFigures 15 and 16 in Supplement 2).

Sensitivity Analyses

In the diabetes cohort, when an HbA_{1c} level of 7.5% was used as the threshold for outcomes, the adjusted odds of patient-months with low-value care were lower in the intervention period compared to the control period, but the difference was not significant (eTable 3 in Supplement 2). The adjusted odds of patient-months with low-value care were lower in the intervention period compared to the control period when patient-months without a preceding HbA_{1c} value were included and classified as not having low-value care (aOR, 0.67; 95% CI, 0.51-0.89) and when patient demographics were omitted as independent variables (aOR, 0.63; 95% CI, 0.42-0.95). In all sensitivity analyses, the odds of deintensification of hypoglycemic medications were higher during intervention patient-months than control patient-months.

Discussion

The multicomponent Committing to Choose Wisely behavioral economic intervention engaged primary care clinicians and older patients to reduce low-value care across 3 common

Table 1. Patient Characteristics

Condition	Patients, No. (%)				P value[a]
	Health system 1		Health system 2		
	Control	Intervention	Control	Intervention	
Diabetes cohort					
Sample size, No.[b]	458	781	1415	1899	NA
Hypoglycemic medication[c]	183 (40.0)	278 (35.6)	664 (46.9)	834 (43.9)	.009
Age, mean (SD), y	73.5 (6.5)	73.5 (6.5)	74.3 (6.8)	74.5 (6.9)	.03
Gender					
Men	227 (49.6)	390 (49.9)	718 (50.7)	976 (51.4)	.66
Women	231 (50.4)	391 (50.1)	697 (49.3)	923 (48.6)	
Race and ethnicity group[d]					
Asian, non-Hispanic	35 (7.6)	68 (8.7)	41 (2.9)	52 (2.7)	<.001
Black, non-Hispanic	50 (10.9)	85 (10.9)	237 (16.8)	292 (15.4)	
Hispanic	7 (1.5)	9 (1.2)	12 (0.9)	15 (0.8)	
White, non-Hispanic	346 (75.6)	590 (75.5)	1007 (71.2)	1381 (72.7)	
Other race, non-Hispanic	10 (2.2)	16 (2.1)	23 (1.6)	36 (1.9)	
Unknown race and ethnicity	10 (2.2)	13 (1.7)	95 (6.7)	123 (6.5)	
Insomnia/anxiety cohort					
Sample size, No.	2185	2185	2041	2041	NA
Sedative-hypnotic medication[e]	392 (17.9)	392 (17.9)	784 (38.4)	784 (38.4)	<.001
Age, mean (SD), y	72.6 (6.3)	72.6 (6.3)	73.9 (7.4)	73.9 (7.4)	<.001
Gender					
Men	683 (31.3)	683 (31.3)	588 (28.8)	588 (28.8)	.08
Women	1502 (68.7)	1502 (68.7)	1453 (71.2)	1453 (71.2)	
Race and ethnicity group[d]					
Asian, non-Hispanic	78 (3.6)	78 (3.6)	34 (1.7)	34 (1.7)	<.001
Black, non-Hispanic	87 (4.0)	87 (4.0)	173 (8.5)	173 (8.5)	
Hispanic	19 (0.9)	19 (0.9)	7 (0.3)	7 (0.3)	
White, non-Hispanic	1965 (89.9)	1965 (89.9)	1686 (82.6)	1686 (82.6)	
Other race, non-Hispanic	25 (1.1)	25 (1.1)	36 (1.8)	36 (1.8)	
Unknown race and ethnicity	11 (0.5)	11 (0.5)	105 (5.1)	105 (5.1)	
Prostate cancer screening cohort[f]					
Sample size, No.	751	736	1591	1543	NA
Age, mean (SD), y	79.9 (4.3)	80.0 (4.3)	81.2 (5.3)	81.3 (5.3)	<.001
Race and ethnicity group[d]					
Asian, non-Hispanic	74 (9.9)	71 (9.7)	29 (1.8)	28 (1.8)	<.001
Black, non-Hispanic	27 (3.6)	27 (3.7)	116 (7.3)	112 (7.3)	
Hispanic	13 (1.7)	12 (1.6)	14 (0.9)	14 (0.9)	
White, non-Hispanic	625 (83.2)	614 (83.4)	1302 (81.8)	1264 (81.9)	
Other race, non-Hispanic	11 (1.5)	11 (1.5)	39 (2.5)	38 (2.5)	
Unknown race and ethnicity	1 (0.1)	1 (0.1)	91 (5.7)	87 (5.6)	

Abbreviation: NA, not applicable.

[a] Comparison between 2 health systems during control period.

[b] Excluding patient-months without any preceding hemoglobin A_{1c} values, resulting in different numbers of patients during the control and intervention periods.

[c] Use of at least 1 hypoglycemic medication (defined as any antidiabetic medication other than metformin) at the start of the corresponding study period, regardless of whether this medication use was ultimately classified as low-value care.

[d] Race and ethnicity groups as classified from electronic health record data. The unknown race and ethnicity category included individuals for whom race and ethnicity data were not available.

[e] Use of 1 or more benzodiazepine or sedative-hypnotic medications at the start of the corresponding study period.

[f] Patient-months are censored at the time of a diagnostic prostate-specific antigen test, resulting in different numbers of patients during the control and intervention periods.

clinical situations and led to more deintensification of hypoglycemic medications for diabetes. The intervention did not lead to statistically significant reductions in use of low-value care for any individual patient cohort, likely due to the lower power to find relatively small within-cohort intervention effects, although results for the diabetes cohort were sensitive to prespecified analytic decisions. The intervention did not significantly change use of low-value medications for insomnia or anxiety.

Interventions to reduce use of low-value care often use clinician and patient education[47] but are most likely to be effective when combined with other elements in multicomponent interventions.[48] Our findings align with this evidence and also build on previous studies of behavioral economic interventions to reduce use of low-value care. For example, accountable justification, peer comparison, and poster-sized commitment letters have significantly reduced inappropriate antibiotic prescriptions.[49,50] Peer comparison and individual audit and feedback have reduced the number of pills per opioid prescription for acute pain.[51] Clinician precommitment with point-of-care reminders has reduced unnecessary imaging tests for low back pain.[34] Our approach incorporated some of these strategies yet provides a broader intervention template (ie, matching local improvement opportunities with professional guide-

Table 2. Outcomes for Diabetes, Insomnia/Anxiety, and Prostate Cancer Screening Cohorts

Cohort	Control months		Intervention months		aOR (95% CI)
	%	No. of patient-months meeting outcome criteria/total No. of patients-months at risk for outcome	%	No. of patient-months meeting outcome criteria/total No. of patients-months at risk for outcome	
All 3 cohorts combined, low-value care	20.5	7627/37 116	16.0	7416/46 381	0.79 (0.65-0.97)[a]
Diabetes cohort[b]					
Low-value care[c]	19.6	1345/6864	14.1	1769/12 516	0.69 (0.45-1.05)[d]
Deintensification[e]	5.6	90/1611	5.4	152/2791	1.85 (1.06-3.24)[d]
Intensification[f]	1.2	56/4515	0.6	55/8527	0.71 (0.32-1.58)[d]
Insomnia/anxiety cohort					
Low-value care	32.1	6180/19 223	24.9	5603/22 470	0.77 (0.53-1.13)[d]
Deintensification[g]	2.7	174/6354	2.8	161/5767	0.84 (0.53-1.33)[d]
Intensification[h]	0.9	167/19 223	0.7	155/22 470	1.04 (0.66-1.66)[d]
Prostate cancer screening cohort, low-value care	0.9	102/11 029	0.4	44/11 395	0.69 (0.34-1.40)[d]

Abbreviations: aOR, adjusted odds ratio from multivariable model; HbA_{1c}, hemoglobin A_{1c}.

[a] Odds ratio associated with intervention period overall for the outcome of interest based on a hierarchical logistic regression model, adjusting for study cohort, intervention period, time in months, age, racial and ethnic minority status, study clinic, and patients as random intercepts.

[b] Excluding patient-months without preceding HbA_{1c} values and using an HbA_{1c} threshold of 7%.

[c] Patient-months in which, after an HbA_{1c} level was less than 7.0%, a hypoglycemic medication (ie, any medication for diabetes other than metformin) was continued at the same dose, newly started, or increased; or a hypoglycemic medication was decreased or stopped but another hypoglycemic medication was started or increased.

[d] Odds ratio associated with intervention period overall for the outcome of interest based on a hierarchical logistic regression model, adjusting for intervention period, time in months, age, gender (except for prostate cancer screening cohort analysis), racial and ethnic minority status, study clinic, and patients as random intercepts.

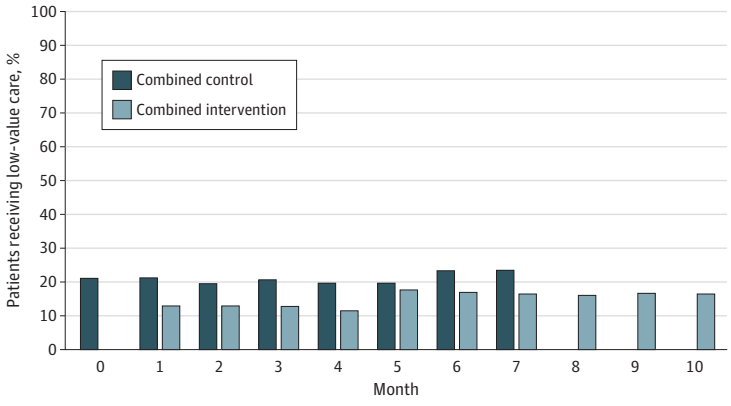
[e] Patient-months in which the most recent HbA_{1c} level was less than 7.0% and there was a discontinuation or dose decrease of a hypoglycemic medication without any new start or dose increase of another hypoglycemic medication.

[f] Patient-months in which the most recent HbA_{1c} level was less than 7.0% and there was a new start or dose increase of a hypoglycemic medication without any discontinuation or dose decrease of another hypoglycemic medication.

[g] Patient-months in which there was a discontinuation or dose decrease of a benzodiazepine or sedative-hypnotic medication without any new start or dose increase of another benzodiazepine or sedative-hypnotic medication.

[h] Patient-months in which there was a new start or dose increase of a benzodiazepine or sedative-hypnotic medication without any discontinuation or dose decrease of another benzodiazepine or sedative-hypnotic medication.

Figure 3. Low-Value Care by Study Month Across Patient Cohorts



Vertical bars represent separately for control and intervention clinics the monthly percentage of patients in the diabetes, insomnia/anxiety, and prostate cancer screening cohorts who received low-value care as defined for that cohort.

lines; soliciting clinician precommitment to these guidelines; and point-of-care supports to promote deliberative thinking, commitment adherence, and social norms) that could be adapted to target different types of low-value care in other settings. Because some exploratory analyses showed that the intervention was less effective over time, more research is needed to determine how interventions that seek to reduce use of low-value care can remain salient in busy practice environments.

Although in our prespecified analyses the intervention did not lead to a significant reduction in use of low-value care for older patients with diabetes, our prespecified and sensitivity analyses all showed that the intervention led to more deintensification of hypoglycemic medications for diabetes. This increased deintensification is important because overtreatment of diabetes is common among older adults[36,52] and infrequently addressed despite its potential for harms.[53-56] Other studies have sought to reduce diabetes overtreatment among older adults through behavioral economic interventions embedded within an EHR.[57-60] Our findings highlight the promise of behavioral economic strategies to address this preva-

lent clinical problem but offer an alternative approach that engages both clinicians and patients without requiring EHR modifications.

In contrast, the Committing to Choose Wisely intervention did not significantly change use of benzodiazepines and sedative-hypnotic medications for insomnia or anxiety. This finding could indicate the greater difficulty that primary care clinicians and patients may have in avoiding use of low-value services for symptomatic conditions relative to asymptomatic conditions.[61] Interventions that used clinician education, patient education, or both have significantly reduced use of benzodiazepines among older patients.[62-67] Little research has tested behavioral economic approaches to reduce overuse of benzodiazepines,[68] and more studies are needed to examine whether such interventions can effectively reduce this type of low-value care.

Limitations

Our study had limitations. We selected and slightly modified for this study 3 Choosing Wisely nonacute care recommendations for older adults and targeted these recommendations with a relatively scalable intervention in academic and community health systems. However, findings may not generalize to all other Choosing Wisely recommendations or practice settings and could be less scalable in some environments. Because cohorts for mailing of patient handouts and data analysis were defined using administrative data and diagnostic codes from encounters in the 12 months before the start of the control period, we were unable to examine effects of the intervention on patients who were newly diagnosed with an applicable condition during the study. We measured outcomes through detailed medical record reviews but lacked data to evaluate the true value of each service for each individual patient. We tested a multicomponent intervention and were not able to isolate the effects of each component. Although the examined medications included both sodium-glucose cotransporter-2 inhibitors and glucagonlike peptide-1 receptor agonists (eTable 1 in Supplement 2), at the time of the study, use of these medications was much less common than it is now.[69,70] This analysis does not use data from surveys and interviews that were conducted with patients and clinicians, but future analyses of these data will yield key insights into experiences with efforts to reduce use of low-value care.

Conclusions

The results of this cluster randomized clinical trial have important implications for clinicians and policymakers. Overuse of low-value care is a worldwide phenomenon[35,71] in need of solutions that can be scaled and sustained across practice environments. Our Committing to Choose Wisely behavioral economic intervention engaged primary care clinicians and older patients to reduce low-value care across 3 common clinical situations and provides a multicomponent template that could be adapted to target use of low-value care in a range of settings. Use of such scalable interventions that nudge patients and clinicians to achieve greater value while preserving autonomy in decision-making should be explored broadly.

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