

# An Informatics Approach to Implement Support for Shared Decision Making for Primary Prevention Statin Therapy

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## Abstract

**Background.** Shared decision making (SDM) is recommended prior to initiation of statin therapy for primary prevention but is underutilized. We designed an informatics decision-support tool to facilitate use of the Mayo Clinic Statin Choice decision aid at the point-of-care and evaluated its impact. **Methods.** Using an iterative approach, we designed and implemented a single-click decision-support tool embedded within the electronic health records (EHRs) to automate the calculation of 10-year atherosclerotic cardiovascular disease (ASCVD) risk and populate the Statin Choice decision aid. We surveyed primary care providers at two clinics regarding their attitudes about SDM before and after deployment of intervention, as well as their usage of and perceived competence regarding SDM for primary prevention statin therapy. Three-month web traffic to the Statin Choice website was calculated before and after deployment of the intervention. **Results.** Pre-post surveys were completed by 60 primary care providers (24 [40%] attending physicians and 36 [60%] housestaff physicians). After deployment of the EHR tool, respondents were more aware of the Statin Choice decision aid ( $P < 0.001$ ), reported being more competent regarding SDM ( $P = 0.047$ ), and reported using decision aids more often when considering statin initiation ( $P = 0.043$ ). There was no significant change in attitudes about SDM as measured through the Patient Provider Orientation Scale (pre  $4.23 \pm 0.40$  v. post  $4.16 \pm 0.38$ ,  $P = 0.11$ ) and the SDM belief scale (pre  $21.4 \pm 2.1$  v. post  $21.1 \pm 2.0$ ,  $P = 0.35$ ). Web-based usage rates for the Statin Choice decision aid increased from 3.4 to 5.2 per 1,000 outpatient clinic visits ( $P = 0.002$ ). **Conclusions.** Implementation of a point-of-care decision-support tool increased the usage of decision aids for primary prevention statin therapy. This effect does not appear to be mediated by any concomitant changes in physician attitude toward SDM.

## Keywords

implementation science, primary prevention, shared decision making, statin

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Shared decision making (SDM) has long been recognized as an important component of patient-centered care, and it is defined as a collaborative process by which patients participate in medical decisions with their clinicians, while informed by both the best evidence and patients' personal values and preferences.<sup>1,2</sup> Recent cardiology guidelines, including the 2013 American Heart Association (AHA)/American College of Cardiology (ACC) Guideline for Management of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults, recommend

SDM for guiding decisions related to the initiation of statin therapy for primary prevention.<sup>3</sup> Unfortunately, many barriers limit the use of SDM during routine clinical practice. These include time constraints, lack of agreement on the

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patient populations to which SDM applies, and lack of awareness about and knowledge of SDM, among others.<sup>4-6</sup>

One innovative approach to improve the practice of SDM is to leverage informatics to implement decision aids for patient and providers to use at the point-of-care.<sup>7</sup> Although SDM is a multistep, collaborative process that focuses on engaging with individual patients, usage of standardized decision aids can play an important role to convey information and facilitate discussion. For primary prevention statin therapy, the Mayo Clinic Statin Choice decision aid has been shown to improve knowledge transfer and reduce decisional conflict, and is highly recommended to facilitate SDM discussions for this clinical scenario.<sup>8,9</sup> A streamlined approach to implement the decision aid into the electronic health records (EHRs) may increase its usage and have the potential to secondarily improve physician attitudes toward SDM by demonstrating its ease-of-use. We therefore undertook the present study, to design and implement an EHR decision-support tool to facilitate use of the Mayo Clinic Statin Choice decision aid at point-of-care, and to evaluate the impact of our intervention on decision aid usage and physician attitudes toward SDM for primary prevention statin therapy.

## Methods

### *Study Setting and Participants*

The study was conducted at one general internal medicine clinic and one family medicine clinic at a large, urban academic medical center (NewYork-Presbyterian Hospital) serving a socioeconomically as well as racially

and ethnically diverse patient population. The two clinic sites were the primary practice locations for 54 attending physicians and 175 housestaff physicians. Allscripts Sunrise Clinical Manager (Allscripts Corp., Chicago, IL) was the primary EHR used at both clinic sites. A locally developed, Java-based service oriented web application, iNYP, renders data from diverse hospital systems and is used by clinicians for advanced data review, in part through custom-built dashboards.<sup>10</sup> Users have access to iNYP both as a custom tab directly from the primary EHR, as well as through web browser and mobile devices.<sup>11</sup>

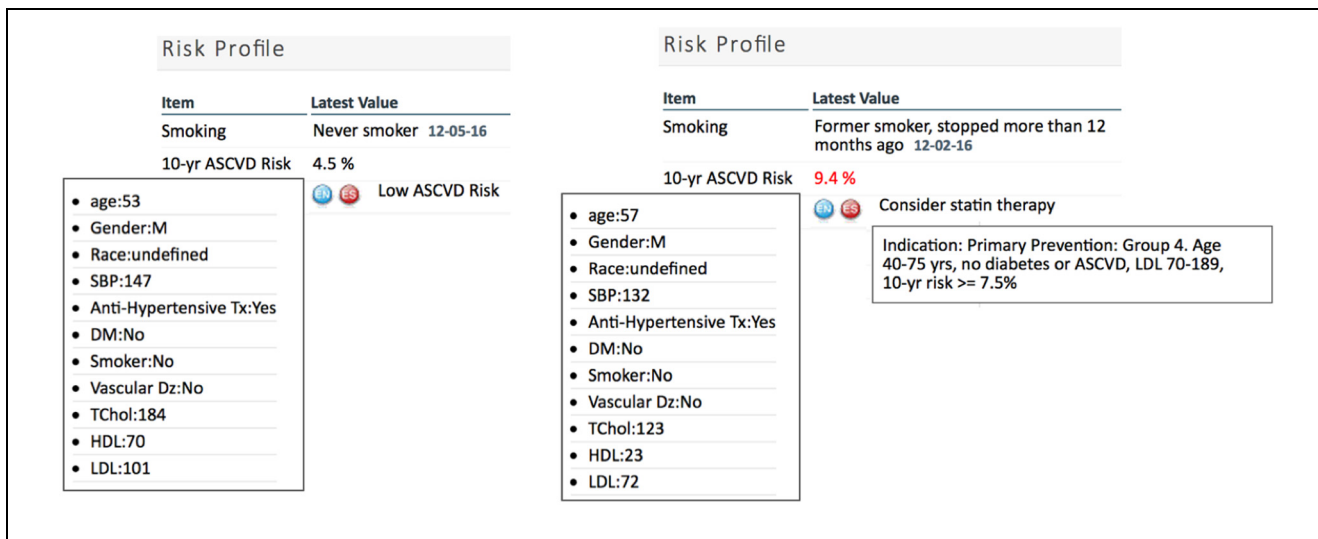
### *Intervention Design*

We designed a decision-support tool to support usage of the Mayo Clinic Statin Choice decision aid in the following fashion. First, we mapped International Classification of Diseases 9th and 10th revisions (ICD-9 and ICD-10) and Healthcare Common Procedure Coding System codes to clinical concepts including atherosclerotic cardiovascular disease and diabetes (see online Supplementary Appendix A). Similarly, we mapped medication classes contained in the Multum Medisource Lexicon<sup>12</sup> to antihypertensives and statins (see online Supplementary Appendix B). We created queries to extract these data elements, along with additional parameters including age, sex, race/ethnicity, smoking status, systolic blood pressure, total cholesterol level, and high-density lipoprotein cholesterol level, needed to calculate estimated 10-year atherosclerotic cardiovascular disease (ASCVD) risk at time of patient encounters. In accordance with the 2013 ACC/AHA Management of Blood Cholesterol Guideline, we created logic to define statin-eligible patients, which include individuals who 1) have clinical ASCVD, or 2) have low-density lipoprotein cholesterol (LDL-C) level  $\geq 190$  mg/dL, or 3) are 40 to 75 years old with diabetes and LDL-C level of 70 to 189 mg/dL, or 4) are 40 to 75 years old with no diabetes or ASCVD, and with LDL-C level of 70 to 189 mg/dL and 10-year estimated ASCVD risk  $\geq 7.5\%$  (see online Supplementary Appendix C).<sup>3</sup>

We applied a user-centered, iterative approach to create and refine the user interface.<sup>13</sup> Specifically, after a prototype was developed, feedback was elicited from potential end-users (NC, NM, and IK). This process led to a streamlined interface to display an automated estimate of 10-year ASCVD risk and provide concise, clinically appropriate decision-support for statin eligibility. Additional details regarding parameters used for risk-estimation and specific reasons for statin eligibility were

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Division of Cardiology (SY) and Division of General Internal Medicine (NC, NM, IK), Department of Medicine, Columbia University Medical Center, New York, New York; Knowledge and Evaluation Research Unit, Mayo Clinic, Rochester, Minnesota (ALL, VMM); NewYork-Presbyterian Hospital, New York, New York (AYC); School of Nursing, Columbia University, New York, New York (LP). Partial findings from this study was presented at the American College of Cardiology 2017 Scientific Sessions, Washington, DC. The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. This project is funded through a Columbia University Medical Center Irving Institute/Department of Biomedical Informatics Health Practice Research Pilot Award, partially supported by the National Center for Advancing Translational Sciences, National Institutes of Health (UL1TR000040). Dr. Ye is supported by a National Institute of Health K23 career development award (K23 HL121144). Dr. Moise is supported by an AHRQ R01 award (R01 HS025198). The funding agreement ensured the authors' independence in designing the study, interpreting the data, writing, and publishing the report.



**Figure 1** Illustration of single-click electronic health record tool to automate the calculation of 10-year atherosclerotic cardiovascular disease (ASCVD) risk and populate the Statin Choice decision aid, through two example patients.

provided contextually via mouse over text boxes, to allow for review and identification of incorrectly entered or missing information. Single-click buttons were designed to embed de-identified data elements into outbound URLs for the English or Spanish version of the Mayo Clinic Statin Choice decision aid website, with the landing page configured to allow review of the parameters prior to finalizing patient-specific decision aids. The final decision-support tool was embedded into an existing, frequently viewed Ambulatory Medicine Dashboard within iNYP, which physicians could navigate to both directly via the web or as a tab within the primary EHR (Figure 1).

### Implementation and Evaluation

The decision-support tool was deployed on March 31, 2016. As part of the roll out, all physicians who worked at the two clinics received via email a brief instruction manual for using the tool and the Statin Choice decision aid. The manual contained screen captures to describe how the tool is used as well as bullet items to highlight the importance of SDM for statin initiation. Additional education about the Statin Choice decision aid and the functionality of the decision-support tool was provided in the form of two in-person conference presentations, and through attending physician champions (NC, NM, and IK) who worked in these clinics and who encouraged the use of the decision-support tool while supervising residents.

Three months prior to decision-support tool deployment, physicians at the two clinics were emailed with a request to complete an online survey that included demographic information, the Patient-Provider Orientation Scale (PPOS) that measures affinity for patient-centered communication,<sup>14</sup> and a Shared Decision Making Belief Scale developed by the Mayo Clinic. The PPOS is scored as the mean of 18 six-point Likert-type items, with higher scores denoting more affinity for patient-centered communication. The Shared Decision Making Belief Scale is scored as the sum of 5 six-point Likert-type items, with higher scores denoting stronger agreement with concepts of SDM. The survey also contained additional Likert-type items assessing respondent usage of 10-year ASCVD risk estimation and decision aids for statin initiation, experiences with the Statin Choice decision aid, and self-reported competence with engaging patients with SDM. All respondents who completed the first survey were asked to complete an identical postintervention survey at 3 months after the decision-support tool was deployed. Respondents were compensated with \$100 for their time completing the questionnaires. The study protocol was approved by the Columbia University Medical Center Institutional Review Board.

For objective measurement of decision aid usage, we tabulated monthly web traffic to the Statin Choice decision aid website from IP addresses originating from the clinics. We obtained monthly total of all outpatient visits to the clinics to calculate the rate of decision aid usage per 1,000 outpatient clinic visits for the 3-month period

**Table 1** Demographics of Respondents ( $n = 60$ )

| Characteristics    | Number (%) |
|--------------------|------------|
| Age                |            |
| 20–39 years        | 42 (70%)   |
| 40–59 years        | 15 (25%)   |
| $\geq 60$ years    | 3 (5%)     |
| Female             | 42 (70%)   |
| Race               |            |
| Asian              | 15 (25%)   |
| Black              | 4 (7%)     |
| White              | 41 (68%)   |
| Hispanic or Latino | 8 (13%)    |
| Training level     |            |
| Intern             | 11 (18%)   |
| Resident           | 25 (42%)   |
| Attending          | 24 (40%)   |
| Specialty          |            |
| Internal medicine  | 43 (72%)   |
| Family medicine    | 17 (28%)   |

immediately before the intervention was deployed, and for the 3-month period immediately after intervention deployment.

### Statistical Methods

We used descriptive statistics to summarize demographic characteristics of survey respondents. We used the paired  $t$  test to compare pre- and postintervention scores for the PPOS and the Shared Decision Making Belief Scale, after confirming that assumptions of normality were not violated. The Wilcoxon signed-rank test was used to compare pre- and postintervention responses for other Likert-type scale items. Pre- and postintervention rates of decision aid usage were compared using the chi-squared test. All analyses were performed using the statistical software Stata SE, version 12.1 (Stata Corp., College Station, Texas).

### Results

For evaluation of the decision support tool, 70 of 229 attendings and housestaff physicians responded to the initial survey and 60 completed both surveys. For internal medicine, 25 out of 157 housestaff physicians and 17 out of 33 attending physicians completed both surveys. For family medicine, 11 out of 18 housestaff physicians and 7 out of 21 attending physicians completed both surveys. Their demographic characteristics are described in Table 1. The majority of those who completed both

surveys were of 20 to 39 years old (42/60 [70%]), were female (42/60 [70%]), and were internists (43/60 [73%]).

For the respondents who completed both surveys, their practice attitudes tended to be “doctor-centered” (defined as a score of 4.57 or less<sup>14</sup>) and did not change before and after the intervention ( $4.23 \pm 0.40$  preintervention v.  $4.16 \pm 0.38$  postintervention,  $P = 0.11$ ). Similarly, respondent score on the Shared Decision Making Belief Scale did not change after the intervention ( $21.4 \pm 2.1$  preintervention v.  $21.1 \pm 2.0$  postintervention,  $P = 0.35$ ). However, after the intervention participants were more likely to report using decision aids to facilitate discussion about statin initiation ( $P = 0.043$ ), mainly driven by a decrease of those who never used decision aids (from 37/60 [62%] preintervention to 23/60 [38%] postintervention). Participants also reported more awareness of the Statin Choice decision aid after the intervention ( $P < 0.001$ ), with a modest increase in those who use it once or occasionally (from 10/60 [17%] preintervention to 17/60 [28%] postintervention) and those who use it routinely (from 1/60 [2%] preintervention to 5/60 [8%] postintervention). Respondents reported increased competence with engaging patients in SDM ( $P = 0.047$ ) after the intervention. There was no significant change in the perception of having received satisfactory training for SDM ( $P = 0.69$ ; Table 2).

Usage rate of Statin Choice decision aid before and after the intervention is provided in Figure 2. When aggregated over the 3-month periods before and after the intervention was deployed, usage rate for the Statin Choice decision aid increased significantly, from 3.4 (95% confidence interval [CI], 2.7 to 4.1) per 1,000 outpatient clinic visits to 5.2 (95% CI, 4.3 to 6.1) per 1,000 outpatient clinic visits ( $P = 0.002$ ).

### Discussion

In this study, we designed a simple-to-use, easy to disseminate EHR tool to automate estimation of 10-year ASCVD risk and facilitate the use of the Mayo Clinic Statin Choice decision aid, and provided low-intensity outreach and education for its use. Following this intervention, we observed improvements in self-reported and objectively measured usage of decision aids for primary preventions statin therapy. Although there were no changes in physician self-reported attitude toward SDM, respondents were more aware of the decision aid and its usage after the intervention.

Our intervention highlights the potential benefits of well-designed, user-centered informatics approaches to facilitate the SDM process. The Statin Choice decision

**Table 2** Effect of the Intervention on Shared Decision-Making Belief and Decision Aid Usage<sup>a</sup>

|  | Pre         | Post        | Ranks <sup>b</sup> | P Value <sup>b</sup> |
|--|-------------|-------------|--------------------|----------------------|
| Patient-Practitioner Orientation Scale   | 4.23 (0.40) | 4.16 (0.38) | NA                 | 0.11                 |
| Shared Decision Making Belief Scale  | 21.4 (2.1)  | 21.1 (2.0)  | NA                 | 0.35                 |
| Question 1: "Before starting a patient on a statin for primary prevention, I will calculate her or his 10-year ASCVD risk to guide the decision"                           |             |             |                    |                      |
| Never  | 0 (0%)      | 0 (0%)      | Positive: 8        | 0.69                 |
| Occasionally   | 5 (8%)      | 3 (5%)      | Negative: 7        |                      |
| Half of the time   | 4 (7%)      | 4 (7%)      |                    |                      |
| Most of the time   | 23 (38%)    | 24 (40%)    |                    |                      |
| All of the time  | 28 (47%)    | 29 (48%)    |                    |                      |
| Question 2: "Before starting a patient on a statin for primary prevention, I will use a decision aid (such as Statin Choice), to facilitate a discussion with the patient" |             |             |                    |                      |
| Never  | 37 (62%)    | 23 (38%)    | Positive: 24       | 0.043                |
| Occasionally   | 13 (22%)    | 23 (38%)    | Negative: 11       |                      |
| Half of the time   | 2 (3%)      | 7 (12%)     |                    |                      |
| Most of the time   | 5 (8%)      | 6 (10%)     |                    |                      |
| All of the time  | 3 (5%)      | 1 (2%)      |                    |                      |
| Question 3: "I have received satisfactory training on how to engage patients with shared-decision making"  |             |             |                    |                      |
| Strongly agree   | 4 (7%)      | 6 (10%)     |                    | 0.69                 |
| Agree  | 9 (15%)     | 8 (13%)     | Positive: 17       |                      |
| Slightly agree   | 20 (33%)    | 20 (33%)    | Negative: 19       |                      |
| Slightly disagree  | 12 (20%)    | 10 (18%)    |                    |                      |
| Disagree   | 12 (20%)    | 15 (25%)    |                    |                      |
| Strongly disagree  | 3 (5%)      | 1 (2%)      | Tie: 24            |                      |
| Question 4: "I feel competent engaging patients in shared-decision making, when clinically appropriate"  |             |             |                    |                      |
| Strongly agree   | 7 (12%)     | 12 (20%)    |                    | 0.047                |
| Agree  | 26 (43%)    | 27 (45%)    | Positive: 9        |                      |
| Slightly agree   | 19 (32%)    | 15 (25%)    | Negative: 19       |                      |
| Slightly disagree  | 4 (7%)      | 4 (7%)      |                    |                      |
| Disagree   | 3 (5%)      | 2 (3%)      |                    |                      |
| Strongly disagree  | 1 (2%)      | 0 (0%)      | Tie: 32            |                      |
| Question 5: "What is your level of exposure to the Statin Choice Decision Aid"   |             |             |                    |                      |
| Never heard of it  | 44 (73%)    | 16 (27%)    | Positive: 36       | <0.001               |
| Heard of it but have not seen appropriate patients to use it   | 0 (0%)      | 1 (2%)      | Negative: 2        |                      |
| Heard of it but have not used it   | 5 (8%)      | 21 (35%)    |                    |                      |
| Have used it once or occasionally  | 10 (17%)    | 17 (28%)    |                    |                      |
| Use it routinely   | 1 (2%)      | 5 (8%)      |                    |                      |

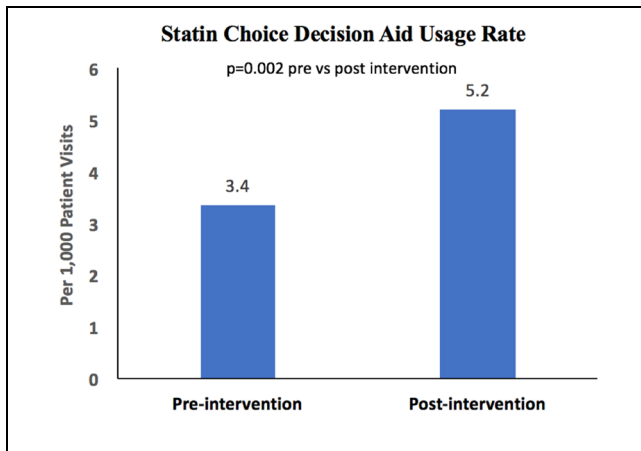
ASCVD = atherosclerotic cardiovascular disease.

a. Values are expressed as mean (standard deviation), or as number (%), where appropriate.

b. *P* values were derived from paired *t* tests for the Patient-Provider Orientation Scale and the Shared Decision Making Belief Scale, and from Wilcoxon signed-rank tests for all other Likert-type scale items. For Questions 1, 2, and 5, positive ranks imply that physicians are more likely to calculate 10-year ASCVD risk, to use a decision aid, or to be exposed to the Statin Choice decision aid after the intervention, respectively. For Questions 3 and 4, positive ranks imply that physicians are more likely to disagree with the item after the intervention.

aid remains underused despite randomized clinical trials evidence supporting their efficacy<sup>8,15</sup> and despite recommendations by major guidelines.<sup>3,16</sup> Our results suggest that by addressing key barriers such as time constraints and the need for additional data, review and entry can increase physician usage of decision aids for SDM. Moreover, our automated approach can be readily adapted to other clinical scenarios where the data elements and decision rules are well defined, and can reduce errors due to manual data entry as part of decision aid usage, as highlighted by a recent report evaluating an

osteoporosis decision aid.<sup>17</sup> Future iterations of this approach might involve direct integration into EHRs, which can further enhance ease of use and reduce manual clicking, though this will also require thoughtful design considerations to minimize information overload and alert fatigue.<sup>13,18</sup> As EHRs evolve and as new payment models emerge to reward SDM,<sup>19</sup> there will be greater opportunities to develop, implement, and evaluate these informatics tools that provide clinicians and patients with smart and timely support for SDM to advance patient-centered care.



**Figure 2** Usage rates (per 1,000 patient visits) for Mayo Clinic Statin Choice decision aid, during 3 months before and 3 months after the intervention.

Nonetheless, our results also demonstrate the limitations of primarily informatics-based approaches to facilitate SDM. SDM is a multistep, patient-centered process that involves presenting information about choices and options and supporting deliberation to reach the decision.<sup>20</sup> Although decision aids can play an important role in this process, a simple intervention that provides decision-support for decision aid use via the EHRs may not be sufficient to address concerns of providers who are not familiar with SDM processes or who feel they have inadequate training. Consistent with this, our intervention with a relatively low-intensity outreach and education component failed to significantly change physician attitudes toward SDM, and almost half of respondents reported being unsatisfied with the training they received for SDM. Although our decision-support tool may have modestly increased Mayo Clinic Statin Choice decision aid usage, it is possible that this was primarily driven by physicians who were already predisposed to engaging in SDM discussions with their patients. Broader uptake of SDM approaches may require more extensive training and education, but such efforts are also likely to be more resource intensive.<sup>9</sup> Other innovative approaches, such as providing incentives for health systems and external vendors to provide SDM support through centralized resources, may play a complimentary role to informatics interventions and clinician education and training.<sup>19</sup> Future research should focus on developing and refining these models of SDM facilitation and should rigorously evaluate their costs and benefits.

There are also a number of limitations to our study. We employed a pre-post study design using a locally

maintained clinical data review platform for implementation and carried out the study at a general internal medicine and a family medicine clinic at a single academic medical center. These factors may reduce the rigor of our findings as well as their external validity. However, we have provided detailed instructions in the online supplement that include diagnosis code mappings and decision-support logic used for our implementation, to support adoption to other EHRs at other health care institutions. Our study also relied on local champions (NC, NM, and IK) as part of the team that disseminated and supported the use of the decision-support tool, and though it is not possible to quantify their impact, it is likely that replication of our approach would require similar or greater amount of support and involvement from local stakeholders. We observed increased rates of decision aid usage through web traffic counts that captured usage for both survey respondents and nonrespondents, but we were unable to link de-identified web traffic to individual provider or patients, nor assess the quality of the SDM process during actual clinical encounters. We used a pre-post design to assess the impact of our intervention over a brief 3-month period, which cannot rule out other factors such as change in case mix or secular trends that could have affected the usage of the decision aid. Longer follow-up is needed to determine durability of our results and long-term effectiveness. In addition, only a quarter of respondents participated in both the pre and post surveys, and it is possible that nonrespondents may hold different attitudes about our intervention and about decision aid usage for statin initiation. Finally, despite our intervention, the usage of the decision aid for primary prevention statin initiation remains low, and we were not able to estimate the proportion of primary prevention statin eligible patients who received SDM discussions. Further research is required to assess whether additional education and outreach efforts or health system interventions can more effectively improve SDM for statin therapy.

In conclusion, by developing a user-centered, point-of-care decision-support tool embedded in the EHRs that supported the use of the Mayo Clinic Statin Choice decision aid, we were able to increase awareness and usage of the decision aid for primary prevention statin therapy. This effect does not appear to be mediated by any concurrent changes in physician attitude toward SDM.

### Supplemental Material

The online supplementary appendix for this article is available on the *Medical Decision Making Policy & Practice* website at <http://journals.sagepub.com/home/mpp>.

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