Primary Prevention Insights

ORIGINAL RESEARCH

An Employer-Based Online Tool for Providing Appropriate Aspirin Use Advice

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Abstract: Suboptimal aspirin use can result in unnecessary and preventable cardiovascular events. Empowering consumers to approach physicians may provide an effective strategy to overcome barriers to optimal aspirin use. We developed an online aspirin advice tool that provided individually tailored recommendations based on current use and clinical cardiovascular risk profile. Advice included a summary report to prompt future conversations with a physician. We pilot tested the tool among Stanford University employees (n = 174) to determine its potential utility as part of an online employee Health Risk Appraisal (HRA). Results showed underuse of aspirin in the Secondary Prevention (73% on aspirin) and High Risk (56%) groups and possible over-use in the Low Risk (11%) group. Participants rated the tool as helpful (73%) and reported plans to follow-up with a physician (76%), especially when current aspirin use was discordant with advice. Online tools to improve aspirin use may be a useful component of employee HRAs.

Keywords: cardiovascular disease, prevention, employee health risk appraisal, technology

Primary Prevention Insights 2012:3 1–9

doi: 10.4137/PPRI.S10073

This article is available from http://www.la-press.com.

Background

Aspirin use can prevent cardiovascular disease events in individuals with known vascular disease, as well as those at high risk for such events (primary prevention).[1] In particular, women at high risk for stroke and men at high risk for myocardial infarction (MI) obtain net benefit from daily use of low-dose aspirin.[2,3] Unfortunately, aspirin appears to be underutilized, particularly for high risk individuals without known vascular disease.[4,5] This results in unnecessary morbidity and mortality from preventable cardiovascular events, including stroke and MI.

Many barriers have been identified that may interfere with optimal use of aspirin. These include underestimation of aspirin's benefits, concern about adverse effects, inadequate consumer understanding of aspirin, lack of reimbursement for aspirin counseling, the failure of physicians to discuss aspirin use with their patients, and continuing controversies regarding aspirin recommendations for primary prevention.[6–13] Several strategies have been proposed to overcome these barriers. These approaches focus on physician education, consumer education, reimbursement for preventive services, and measurement and audit of physician practice patterns. Strategies aimed at empowering consumers to approach their physicians also may be particularly effective because they can activate patients regarding their own prevention activities, while also helping them to avoid inappropriate consumer decisions that would be unwise clinically.

We developed and pilot tested an online tool for employees at Stanford University that provides guidance about appropriate aspirin use. It was disseminated for voluntary completion through an employee email list. We evaluated this tool's suitability for inclusion in a comprehensive online employee Health Risk Appraisal (HRA) that is completed annually by a large proportion of employees.

Methods

We developed an online aspirin advice tool and pilot tested the tool with 174 employees at Stanford University.

Development of the aspirin advice tool

We designed a user interface with Survey Monkey that made use of multiple skip logic steps to tailor the advice to each respondent's current aspirin use and clinical risk profile. Advice centered on providing an individualized and graded recommendation for or against aspirin use, including a summary report with instructions to use this information in future discussions with physicians. The participants were invited to print the summary report prepared by the tool to help prompt such conversations. We used a simplified algorithm for identifying individuals in whom aspirin use would be likely to provide benefits in excess of risks. This algorithm was developed by the American College of Preventive Medicine and Partnership for Prevention's Council on Aspirin for Prevention and Health. This prior work was based on the US Preventive Services Task Force (USPSTF) recommendations[14] that were simplified for practical application where risk factors might be known (eg, presence of high blood pressure), but where values of specific risk factors might be unavailable (eg, specific serum cholesterol laboratory results). For men, factors used for risk stratification included smoking, high cholesterol, hypertension, family history of premature heart disease, and presence of known vascular disease or diabetes. For women, factors evaluated were smoking, left ventricular hypertrophy, presence of vascular disease, and diabetes. Aspirin use was defined as use at least every other day for prevention. We also accounted for complicating clinical conditions (eg, past gastrointestinal (GI) bleeding), current medications (eg, warfarin), and past aspirin intolerance. This algorithm identified four graded risk groups (see Table 1A):

1. Secondary Prevention (aspirin clinically required). "Any of the following: past stroke or mini-stroke (TIA), past heart attack (MI), past surgical procedures on coronary or carotid arteries, or diagnosed with angina or coronary heart disease."
2. High Risk (aspirin recommended): All men ages 55–79 yrs., men ages 45–54 yrs. with 1+ risk factors, and women ages 55–64 yrs. with 2+ risk factors.
3. Intermediate Risk (aspirin use reasonable): Men ages 45–54 yrs. without risk factors and women ages 55–79 yrs. with 1 risk factor.
4. Low Risk (aspirin not recommended): Men $<$ 45 yrs., women $<$ 55 yrs.; and women 55–79 yrs. without risk factors.

Individuals 80+ years were defined as having "Insufficient Evidence" to gauge aspirin's benefits

Table 1A. Aspirin use categories of survey participants by gender.

Aspirin use categories	N	(%)	Female N	(%)	Male N	(%)	*P*-value*
Total participants	174	100.0	123	70.7	37	21.3	
Existing CHD/stroke history	15	8.6	–	n/a	n/a	–	
Aspirin recommended	34	19.5	7	4.0	27	15.5	
Aspirin reasonable	34	19.5	28	16.1	6	3.5	<0.01
Aspirin not recommended	90	51.7	87	50.0	3	1.7	
No evidence (80+)	1	0.6	1	0.6	1	0.6	

Notes: N = 174, Stanford University employees and contacts, 2011. *Differences in risk factor categories by gender (excluding existing CHD where age-gender information was not available [n/a]).

(no aspirin recommendation, based on USPSTF determination).[14] Prior to broader pilot testing, we conducted preliminary testing of the online tool.

Pilot test

As our goal was to evaluate the online tool for potential inclusion in an employee HRA, we asked for volunteers to pilot test the tool through an employee email list. This list was composed of employees who actively opted in for the purpose of being in email contact with fellow employees. The list was not used for official employer communications. This email list included 800 employees at the time of the pilot test. Because the majority of University employees are female and below the age of 55 years, we sought to enrich the sample of higher risk individuals by asking employees to forward the online tool link to older friends and relatives (male or female) who might have an interest in receiving aspirin advice.

In December 2010, we sent three separate emails to this email list asking for volunteers to anonymously participate in the pilot test and provide feedback about the online advice tool. The email included a link to the advice tool. Users of the tool were asked to assess the usefulness of the advice and report their likelihood of following up with a physician. We provided no reimbursement or other incentive for participation. A total of 174 individuals completed the advice tool.

Tool development and pilot testing was funded by an unrestricted research gift from Partnership for Prevention (Washington DC).

Analysis

Our descriptive analysis of the online survey results were conducted using Microsoft Excel (Microsoft Corporation, Seattle) and SAS, Version 9.2 (SAS Institute Inc., Cary, NC). We investigated differences between the recommendations of the online tool and current aspirin use of the respondents and the usefulness of the information obtained by risk group. We tested for statistically significant differences between groups using chi-square test or Fisher's exact test in cases where the cell frequency was less than 5. We considered $P < 0.05$ (two-sided) to represent statistically significant differences. Finally, we used logistic regression to calculate adjusted odds ratios (OR) and 95% confidence intervals (CIs) of the independent effect of respondent characteristics on the likelihood of seeking physician advice regarding aspirin. We used forward stepwise

Table 1B. Risk categories of aspirin use survey participants by gender and age.

Age	Total N	(%)	Female < 55	Male < 45	Male 45–54	55–79 years		80+ years		*P*-value*
Risk factors						Female	Male	Female	Male	
No risk factors	103	(59.2)	37	3	6	50	6	1	0	
1 risk factor	42	(24.1)	0	0	4	28	10	0	0	<0.01
2 + risk factors	14	(8.0)	0	0	1	7	6	0	0	
CHD/stroke	15	(8.6)	←15** →							

Notes: N = 174, Stanford University employees and contacts, 2011. *Difference in risk factor categories by age-group/gender categories (excluding existing CHD where age-gender information was not available [n/a]). **This information was asked prior to demographics.

selection, and variables with a $P < 0.05$ were retained in the model.

Results

Of the 174 users of the online tool, most (71%) were women and many (59%) had no cardiovascular risk factors (other than gender and age, Table 1). A majority of participants (52%) were in the low risk category and thereby received advice that aspirin was not recommended. Known vascular disease was reported by 9% (Secondary Prevention group; aspirin use clinically required in the absence of very strong contraindication), while 19.5% were at High Risk (aspirin recommended), and 19.5% were at Intermediate Risk (aspirin use may be reasonable). One individual was above 80 years and thereby in the Insufficient Evidence group.

Overall aspirin use was 32% (Table 2). Aspirin use was more likely for respondents in higher risk categories ($P < 0.01$) and ranged from 11% in the Low Risk group (aspirin not recommended) to 73% in the Secondary Prevention group (Table 2). Aspirin use was 41% in the Intermediate Risk group and 56% in the High Risk group. Use in men (42%) was greater than in women (24%).

Approximately half of participants had not discussed aspirin use with their physicians (54%). This was particularly true in the Low Risk group (77%), but such discussions were more common as risk increased. Lack of a discussion was reported in only 13% of the Secondary Prevention group (Table 2). Overall, 32% of participants reported receiving a physician recommendation to use aspirin. Only 2% received advice not to take aspirin and 13% received no clear recommendation despite a reported discussion. Lack of reported advice despite a discussion was particularly common for those in the High Risk group (27% of this group overall or 38% among those reporting any physician discussion). Physician advice recommending against aspirin use was rare even for those individuals at Low (2%) or Intermediate Risk (3%).

Participants generally reported that the tool was very helpful (37%) or somewhat helpful (36%). In addition, participants reported that they were very likely (18%) or somewhat likely (22%) to seek advice from their physicians as a result of their online participation. Reported usefulness was uniform across all risk groups (Table 3). Lower perceived helpfulness was reported for those in the secondary prevention group who were taking aspirin (55%) compared to all other groups (mean 75%, range 64% to 100%).

Univariate analyses showed that plans to seek physician advice were greatest in groups at High Risk (62%) and Intermediate Risk (50%), while less likely in the Secondary Prevention (40%) and Low Risk (29%) groups. Risk level remained significant in the multivariate model with an adjusted odds ratio of 2.6 (95% CI: 1.2–5.3) associated with having one or more risk factors ($P = 0.01$) (Table 4). Seeking physician advice was greatly increased where a discrepancy existed between current aspirin use and the advice provided by the tool in the univariate analysis, and it remained significant ($P < 0.01$) in the multivariate model (OR = 3.5, 95% CI: 1.6–7.5) (Table 4). Almost three-quarters of those not taking aspirin, but recommended to do so by the tool, reported that they were at least somewhat likely to seek advice. Similarly, 80% of those taking aspirin while the tool advised against this planned to seek advice. As expected, when participants were not taking aspirin in concordance with the online tool's advice against aspirin use, they had limited likelihood of seeking physician advice (22%). The multivariate analysis also revealed that, accounting for other factors, those who felt the tool was helpful had greater odds ($P < 0.01$) of seeking physician advice (OR = 3.6, 95% CI: 1.7–7.4), and that females had lower odds than males ($P = 0.03$) of seeking physician advice (OR = 0.4, 95% CI: 0.2–0.9) (Table 4).

Written comments were provided by 52 participants. Most were favorable and commented on the utility of the tool. Seven (13%) suggested that special circumstances limited usefulness of the advice. These include past adverse effects of aspirin or strong family history. Some participants felt it unnecessary to reinforce current use status that was consistent with the online advice. Others suggested adding incentives, describing adverse effects, and discussing or recommending aspirin dosage.

Discussion

In this successful pilot test, employees and some of their close contacts completed an online tool that

Table 2. Aspirin use and physician (MD) recommendations.

	Total frequency (N)	Taking aspirin	Aspirin use%	*P*-value*	Discussed risks with MD/recommended to use aspirin				
					No discussion with MD%	Aspirin recommended by MD %	Aspirin not recommended %	No recommendation %	*P*-value*
Female	123	29	23.6		64.2	26	2.4	7.3	
<55	37	2	5.4		94.6	2.7	0.0	2.7	
55–79	85	26	30.6		51.8	35.3	3.5	9.4	
80+	1	1	100.0		0.0	100.0	0.0	0.0	
Male	36	15	41.7	<0.01	36.1	33.3	0.0	30.6	<0.01
<45	3	0	0.0		100.0	0.0	0.0	0.0	
45–54	11	5	45.5		27.3	45.5	0.0	27.3	
55–79	22	10	45.5		31.8	31.8	0.0	36.4	
80+	0	0	0.0		0.0	0.0	0.0	0.0	
Risk status									
No risk factors	103	14	13.6		71.8	16.3	1.9	9.7	
1 risk factor	42	21	50.0	<0.01	35.7	45.2	2.4	16.7	<0.01
2+ risk factors	14	9	64.3		21.4	57.1	0.0	21.4	
Total primary prevention	159	44	27.7		57.9	27.7	1.9	12.6	
Risk groups									
Existing CHD/stroke Hx	15	11	73.3		13.3	73.3	0.0	13.3	
Aspirin recommended	34	19	55.9		29.4	44.1	0.0	26.5	
Aspirin reasonable	34	14	41.2	<0.01	38.2	44.1	2.9	14.7	<0.01
Aspirin not recommended	90	10	11.1		76.7	14.4	2.2	6.7	
No evidence (80+, no CVD/Stroke)	1	1	100.0		0.0	100.0	0.0	0.0	
Total primary and secondary	174	55	31.6		54	31.6	1.7	12.6	

Notes: N = 174, Stanford University employees and contacts, 2011. *Differences in aspirin use and in aspirin discussion/recommendation categories by age/gender, risk status, and risk groups.

Table 3. Perceived helpfulness of the survey tool and likelihood of physician (MD) follow-up.

Risk groups	Frequency	Percent	Likely or somewhat likely to seek MD advice			Tool very or somewhat helpful		
			N	%	*P*-value	N	%	*P*-value
Heart attack or stroke	15	8.6	6	40.0		9	60.0	
Aspirin yes	11	73.3	5	45.5	0.6	6	54.6	1.00
Aspirin no	4	26.7	1	25.0		3	75.0	
Aspirin eligible	34	21.4	21	61.8		27	79.4	
Aspirin yes	19	55.9	10	52.6	0.30	16	84.2	0.63
Aspirin no	15	44.1	11	73.3		11	73.3	
Aspirin reasonable	34	21.4	17	50.0		24	70.6	
Aspirin yes	14	41.2	7	50.0	1.00	9	64.3	0.70
Aspirin no	20	58.8	10	50.0		15	75.0	
Low risk (no aspirin)	90	56.6	26	28.9		67	74.4	
Aspirin yes	10	11.1	8	80.0	<0.01	8	80.0	0.44
Aspirin no	80	88.9	18	22.5		59	73.8	
No good evidence	1	0.6	0	0.0		1	100.0	
Aspirin yes	1	100.0	0	0.0	–	1	100.0	–
Aspirin no	0	0.0	0	0.0		0	0.0	

Notes: N = 174, Stanford University employees and contacts, 2011. *Differences in likelihood of seeking advice and tool usefulness by current aspirin use status.

provided tailored advice about appropriate aspirin use in an effort to prevent cardiac and cerebrovascular disease. We noted a moderate level of aspirin use (32%) among participants. As expected, reported use of aspirin was positively correlated with increasing cardiovascular risk. Even so, a sizable fraction of participants were not taking aspirin despite being in the Secondary Prevention (27%) or High Risk (44%) groups (where aspirin is recommended). Further, 11% of Low Risk participants (aspirin not usually recommended) reported ongoing aspirin use. These findings indicate a suboptimal pattern consistent with both under- and over-use of aspirin.

Approximately half of participants had not discussed aspirin with their physicians (54%) or such discussions had not yielded a recommendation for or against aspirin use (13%). Even in the Low Risk group, physicians rarely recommended against aspirin use (2% overall, or 9% among those having a discussion). This indicates an important gap that was targeted by the online tool.

The online tool was uniformly rated as very helpful or somewhat helpful (73%), although perhaps less so in the Secondary Prevention group taking aspirin, a group very likely to have had exposure to aspirin counseling. Many participants reported that they were likely or somewhat likely (40%) to seek physician advice based on the online tool. Plans to seek advice were especially common (76%) when current use was discordant with the online advice. Thus, the online tool was most successful for those individuals expected to have the greatest benefit from physician advice to clarify the appropriateness of aspirin use. Among this largely younger, female population of employees, our findings highlight a need to focus on aspirin overuse in individuals at low risk of cardiovascular events. Aspirin use in these individuals may offer only small absolute prevention

Table 4. Odds ratios (OR) and 95% confidence intervals (CI) of seeking physician advice by participant characteristics.

Characteristic	Estimated OR	95% CI	*P* value
Survey is helpful (yes)	3.6	(1.7–7.4)	<0.01
Gender (female)	0.4	(0.2–0.9)	0.03
One or more risk factors	2.6	(1.2–5.3)	0.01
Advice vs. use discrepant	3.5	(1.6–7.5)	<0.01

Notes: N = 174, Stanford University employees and contacts, 2011.

benefit—ie, a large number of individuals may need to take aspirin to prevent a single cardiovascular event. In some of these individuals, the risks associated with aspirin use may approach or even exceed these limited benefits.

While participants had a favorable impression of the tool, several changes might further increase its usefulness and satisfaction levels. These include clearer statements about potential complicating clinical factors that might lead to physician decisions at odds with the online advice. In addition, the use of active links to online resources might provide needed information for those seeking in-depth explanations about the risks and benefits of aspirin use.

Several limitations of this pilot test should be acknowledged. Despite our attempts to expand the sample to higher risk individuals, most participants were at low risk for cardiovascular disease events. This limits our ability to definitively judge the utility of the online tool for higher risk participants. The University employee population targeted by the web-based tool may have higher socioeconomic status and greater computer skills than other employee groups. This necessitates caution in generalizing our findings. The online tool was used anonymously and, therefore, we have no information about whether participants who expressed plans to seek physician advice actually did so. In addition, only limited clinical details could be incorporated into our risk stratification algorithm.

Current algorithms for determining aspirin eligibility are evolving. We have largely relied on the 2009 recommendations of the USPSTF, but acknowledge that two areas are particularly controversial. First, new meta-analyses[7,9,11] and recommendations[8] suggest an altered balance of risks and benefits less favorable to aspirin use in primary prevention. While analyzing essentially much of the same data as the USPSTF, these publications generally assume that adverse events (mostly GI bleeding) and cardiovascular events prevented are equally important. In response, the USPSTF has argued that the greater severity of cardiovascular events justifies their approach and continued consideration of aspirin for primary prevention.[15] Second, new studies cast doubt on whether patients with diabetes (in the absence of other indicators for aspirin use) obtain net benefit from aspirin use.[10,16–18] Although we considered diabetes a risk factor in risk stratification (as does the USPSTF), we did not include diabetes as a cardiovascular disease equivalent as is the case in other risk factor management guidelines.[19] We also note that there is emerging evidence for a benefit of aspirin in the prevention of colon and possibly other cancers.[20–24] These complexities reinforce our approach of emphasizing the need for tailored advice from a physician. We do acknowledge, however, that not all primary care physicians may be equally able to navigate through the available evidence and conflicting recommendations.

Conclusion

This pilot test was successful in providing important and needed advice on aspirin use for the prevention of cardiovascular disease that many participants found helpful. In addition, the pilot test indicated that many participants had not discussed aspirin use with their physicians, and the online tool was seen as particularly helpful for participants where clarification of aspirin advice was needed. Therefore, this online aspirin advice tool (with the enhancements suggested by this pilot) might be usefully incorporated as a routine component of online employee Health Risk Appraisals at Stanford University and elsewhere. Particularly when combined with other strategies, such as efforts to increase physician awareness of aspirin's risks and benefits or informational approaches targeting consumers, an online employee advice tool may help improve appropriate aspirin decision-making.

Acknowledgments

We would like to thank the Partnership for Prevention for funding this research as well as the staff of the Stanford Health Improvement Program for their help in refining the tool before publication, and the Stanford employees and their contacts for participating in the pilot test.

Competing Interests

Author(s) disclose no potential conflicts of interest.

Author Contributions

Conceived and designed the experiments: RSS. Analyzed the data: RSS, ST. Wrote the first draft of the manuscript: RSS. Contributed to the writing of the manuscript: LGR, AKF, ST. Agree with manuscript

results and conclusions: RSS, LGR, AKF, ST. Jointly developed the structure and arguments for the paper: RSS, ST. Made critical revisions and approved final version: RSS, LGR, AKF, ST. All authors reviewed and approved of the final manuscript.

Disclosures and Ethics

As a requirement of publication, authors have provided to the publisher signed confirmation of compliance with legal and ethical obligations including but not limited to the following: authorship and contributorship, conflicts of interest, privacy and confidentiality and (where applicable) protection of human and animal research subjects. The authors have read and confirmed their agreement with the ICMJE authorship and conflict of interest criteria. The authors have also confirmed that this article is unique and not under consideration or published in any other publication, and that they have permission from rights holders to reproduce any copyrighted material. Any disclosures are made in this section. The external blind peer reviewers report no conflicts of interest.

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Supplementary Information

Appendix 1. Aspirin survey tool text (PDF).