

Frequency and Prioritization of Patient Health Risks from a Structured Health Risk Assessment

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ABSTRACT

PURPOSE To describe the frequency and patient-reported readiness to change, desire to discuss, and perceived importance of 13 health risk factors in a diverse range of primary care practices.

METHODS Patients (n = 1,707) in 9 primary care practices in the My Own Health Report (MOHR) trial reported general, behavioral, and psychosocial risk factors (body mass index [BMI], health status, diet, physical activity, sleep, drug use, stress, anxiety or worry, and depression). We classified responses as "at risk" or "healthy" for each factor, and patients indicated their readiness to change and/or desire to discuss identified risk factors with providers. Patients also selected 1 of the factors they were ready to change as most important. We then calculated frequencies within and across these factors and examined variation by patient characteristics and across practices.

RESULTS On average, patients had 5.8 (SD = 2.12; range, 0-13) unhealthy behaviors and mental health risk factors. About 55% of patients had more than 6 risk factors. On average, patients wanted to change 1.2 and discuss 0.7 risks. The most common risks were inadequate fruit/vegetable consumption (84.5%) and overweight/obesity (79.6%). Patients were most ready to change BMI (33.3%) and depression (30.7%), and most wanted to discuss depression (41.9%) and anxiety or worry (35.2%). Overall, patients rated health status as most important.

CONCLUSIONS Implementing routine comprehensive health risk assessments in primary care will likely identify a high number of behavioral and psychosocial health risks. By soliciting patient priorities, providers and patients can better manage counseling and behavior change.

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INTRODUCTION

Given the evidence for behavioral factors as primary determinants of health,^{1,2} systematic assessment of patient-reported health behaviors and psychosocial well-being has important implications for patient care.^{3,4} Although national data on health risks exist, for instance in the Behavioral Risk Factor Surveillance System (BRFSS) and National Health Interview Survey (NHIS) data,^{5,6} health risk assessments (HRAs) are important tools for understanding the frequency of individual and coexisting patient-reported health risks in primary care.^{3,7} The utility of most existing HRAs, however, is limited by the difficulty of integrating them into routine care, and by their infrequent use (eg, for new patients only).³ Furthermore, most HRAs are not patient-centered in that they do not solicit patients' levels of concern about identified risk areas or provide a way for patients to designate their priorities for change.³ The feasibility of implementing comprehensive HRAs has been limited by time constraints, by the length and impracticality of available assessment tools,⁸ and by the difficulty of deriving data from them that can be acted on in the clinical encounter.⁹⁻¹¹

HRAs are now supported as part of the Medicare Annual Wellness Visit established by the Affordable Care Act.^{12,13} Thus, the development of brief, reliable, valid, and actionable pragmatic HRAs is timely and relevant to

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patients and health care teams.^{3,7} The My Own Health Report (MOHR) was developed to meet this need.

MOHR differs from traditional HRAs in several ways:

- It was developed in conjunction with key stakeholders using items from existing well-validated measures.
- It assesses behaviors and mental health risks (eg, sleep, stress, anxiety) that traditional HRAs may not.
- It provides immediate feedback to patients on their risk factors.
- It is also more patient-centered and clinically relevant in that it allows patients to identify and prioritize risk factors they are ready to change and want to discuss with their providers and includes a goal-setting worksheet to assist patients in action planning to reduce risk(s).

Before MOHR or similar HRAs can be fully disseminated and integrated into primary care, however, more must be known about the frequency of patient health risks and patient preferences. This knowledge is needed for prioritization of practice and provider resources and for help in identifying which assessment results are most productive to act on.^{3,7}

The MOHR¹⁴ pragmatic implementation trial was conducted to test the feasibility of implementing the MOHR HRA feedback system^{3,7} in diverse primary care practices. This manuscript seeks to report on the frequency of patient risk factors; the mean total number of risk factors per patient; and patients' perceptions of importance, readiness to change, and desire to discuss identified risks with providers.

METHODS

Details regarding design of the MOHR study are provided elsewhere.¹⁴ Briefly, 9 pairs of primary care practices throughout the United States were randomized to early fielding of the MOHR assessment tool or delayed fielding with an initial period of usual care for comparison. Consistent with the objective of a pragmatic trial, implementation of MOHR was tailored to each practice's resources and workflow,^{14,15} but the content was standardized across practices. The MOHR assessment was fielded electronically via <http://www.myownhealthreport.org> in 8 of the 9 intervention sites, and via paper and pencil at 1 site (Site 2) that primarily served low-literacy patients. The majority of practices targeted patients coming in for chronic disease management and wellness visits for MOHR assessment. Eligible patients were instructed to complete the MOHR assessment either before or during their primary care appointment and told their responses would be used to help their doctor give them better, more personalized care. Summaries of patient MOHR results were auto-

matically printed (2 practices) or faxed to providers (6 practices) upon completion, depending on practice preference.¹⁴ All study procedures were approved by the Institutional Review Boards at participating sites.

Setting

Details about practices and patient recruitment are provided elsewhere.^{14,16} Practices were geographically diverse, and 5 were rural and/or federally qualified health centers.¹⁷ Practice size ranged from 1 to 5.5 full-time-equivalent providers. Prevalence of patients covered by Medicare or Medicaid ranged from 0% to 49%. Between 1% and 69% of patient populations were uninsured.¹⁷

Measures

The MOHR tool is a Web-based, 20-item, patient-reported HRA that collects information on 8 socio-demographic elements (sex, age, race, ethnicity, English proficiency, employment status, marital status, and education) and 13 specific health risk factors. Risk factors assessed by MOHR can be grouped into 3 categories: general health (body mass index [BMI], health status), health behaviors (consumption of fruits and vegetables, fast food, and sugary beverages; physical activity; sleep; use of alcohol, tobacco and illegal drugs; and misuse of prescription drugs) and psychosocial factors (stress, anxiety or worry, and depression).^{7,14} Patients who gave positive responses to initial screening questions about depression, anxiety or worry, alcohol use, illegal drug use, or misuse of prescription drugs were asked additional follow-up screening questions.¹⁷⁻²¹ While depression and anxiety are clinically significant disorders, the MOHR tool was intended to assess risk and is not a diagnostic tool. Therefore, they are referred to as risk factors throughout this report.

Responses for each item were designated as being "low," "some," or "high" risk in accordance with norms and national guidelines. Patients received feedback indicating that their responses were of "none," "some," or "high" concern to their provider in accordance with their risk values and were then asked which risk factors, if any, they were ready to change, which they wanted to discuss with their provider and, of those factors they were ready to change, which they perceived as most important. Due to the constraints of on-site scoring, these contingency questions and additional follow-up questions were excluded from the paper version of MOHR. Item details, sources, and classification cut-points are presented in Table 1. For the purposes of the present analyses, patients were considered "at risk" on a factor if their response was classified as "some" or "high" risk, and "healthy" if their response was classified as "low" risk. All 13 health risk factors were summed to obtain the total number of risk factors (range, 0-13). A

Table 1. MOHR Tool Health Risk Factor Assessment Questions and Risk Classifications

| Health Risk Factor | Question(s) ^{3,7} | Level of Concern/Risk | | |
|--|--|----------------------------|----------------------------|----------------------------|
| | | None "Healthy" | Some "At risk" | High "At risk" |
| BMI ²² | Indicate height and weight | 20-25 | 25 to <30 | ≥30 |
| Fast food intake | Number of fast food meals or snacks over past 7 days | <1 | 1 to 3 | ≥4 |
| Fruit and vegetable intake | Servings of fruits/vegetables eaten per day over past 7 days | ≥5 | 3 to 4 | ≤2 |
| Sugary beverage intake | Number of soda and sugar sweetened drink per day over past 7 days | <1 | 1 to 2 | ≥3 |
| Physical activity ²³ | Number of days of exercise in past 7 days and average number of minutes of exercise per session | ≥150 | <150 | <150 |
| Stress | How much stress experienced in past 7 days (0 to 10) | 0-4 | ≥5 | ≥5 |
| Anxiety or worry ²⁰ | Over past 2 weeks summed frequency of: (1) feeling nervous, anxious or on edge (0 to 3) and (2) not being able to stop or control worrying (0 to 3) | Score <4 | Score ≥4 ^a | Score ≥4 ^a |
| Depression ^{18,19} | Over past 2 weeks summed frequency of: (1) feeling down, depressed or hopeless (0 to 3) and (2) little interest or pleasure in doing things (0 to 3) | Score <4 | Score ≥4 ^a | Score ≥4 ^a |
| Sleep | Daytime sleepiness in past 7 days | Rarely/ never | Often | Always |
| Tobacco use ²⁴ | Used tobacco (smoking or smokeless) in last 30 days | No use | Used | Used |
| Alcohol intake ²⁵ | Number of times in past year have had 4-5 or more drinks in a day ^b | Never | 1 to 3x/year ^a | ≥4x/year ^a |
| Illegal drug use and prescription drug abuse | Number of times in past year have used illegal drug or prescription medication for non-medical reasons | None | Used/ misused ^a | Used/ misused ^a |
| General health rating | General rating of overall health | Good, Very Good, Excellent | Fair | Poor |

^a Follow-up questions were asked, including the Generalized Anxiety Disorder 7-Item Scale²⁰ (GAD-7; for anxiety or worry), Patient Health Questionnaire-9^{18,19} (PHQ-9; for depression), the Alcohol Use Disorders Identification Test²¹ (AUDIT-C; for alcohol intake); Drug Abuse Screening Test¹⁷ (DAST-10; for drug use/misuse).

^b Recommendation varies by gender: 4 applies to women and 5 applies to men.

second risk factor sum was also calculated combining the 3 dietary items into 1 factor (range 0-11).

Data Analyses

We conducted one-way ANOVAs to determine whether the total number of health risk factors varied by each of several patient characteristics alone (sex, age, BMI, race, ethnicity, marital status, education, employment status, and English proficiency) and then when controlling for all other patient characteristics listed above. We ran a logistic regression to compare the proportion of patients classified as at risk for each factor across all 9 practices and adjusted for patient characteristics.

For patients completing MOHR online, the proportions of patients classified as at risk for a given factor who also indicated they were ready to change or wanted to discuss that factor were calculated for each of the 13 risk factors. For those patients indicating they were ready to change a given risk factor, the proportion who also designated that risk factor as most important was calculated.

RESULTS

Participants Characteristics

A total of 1,854 patients answered at least 1 question on the MOHR tool, and 1,707 of those (92.1%;

mean age = 49.3, SD = 14.81) completed all MOHR health risk items. The majority of respondents were women (66.7%), white (67.4%), 50 years of age or older (53.5%), married/living as married (52.3%), spoke English very well (66.9%), and had not earned a college degree (80.5%). About one-third were Hispanic (28.5%) (Table 2).

Health Risk Factors

On average, patients had 5.8 (SD = 2.1; range, 0-13) of 13 possible risk factors. When the 3 dietary components were combined into 1 factor, this was reduced to 4.9 of 11 possible (SD = 1.8; range, 0-11). Over one-half of patients (54.6%) had 6 or more risk factors (34.2% when all dietary factors were combined). Fewer than 1% of patients had no risk factors. After controlling for all other patient characteristics, age, ethnicity, marital status, education, and employment status were significantly associated with total number of health risk factors ($P < .01$ for all) (Table 2).

Frequency of Risk Factors

Table 3 summarizes the average number of risk factors and the frequency of each risk factor for the full sample and by practice. The average number of risk factors per patient for each practice ranged from 4.2 (SD = 2.0) to 6.9 (SD = 1.9). The most frequent

Table 2. Total Number of Health Risk Factors by Patient Characteristics

| Patient Characteristic | No. (%) | Total Risk Factors | | | | | P Value ^a | Adjusted P Value ^{a,b} |
|--|---------------|--------------------|--------|------|-----|-----|----------------------|---------------------------------|
| | | Mean | Median | SD | Min | Max | | |
| Sex | | | | | | | .81 | .82 |
| Male | 568 (33.27) | 5.8 | 6 | 2.23 | 0 | 13 | | |
| Female | 1,138 (66.67) | 5.8 | 6 | 2.07 | 0 | 12 | | |
| Missing | 1 (0.06) | – | – | – | – | – | | |
| Age | | | | | | | <.001 | <.001 |
| <30 ^c | 212 (12.4) | 5.9 | 6 | 2.09 | 1 | 12 | | |
| 30 to <50 | 582 (34.1) | 6.1 | 6 | 2.12 | 0 | 13 | | |
| 50 to 70 | 787 (46.1) | 5.7 | 6 | 2.08 | 0 | 12 | | |
| ≥70 | 126 (7.4) | 4.7 | 5 | 2.04 | 0 | 9 | | |
| Race | | | | | | | .02 | .72 |
| White ^c | 1,219 (71.4) | 5.7 | 6 | 2.15 | 0 | 13 | | |
| Black or African American | 380 (22.3) | 6.1 | 6 | 1.93 | 1 | 11 | | |
| Asian or Pacific Islander | 24 (1.4) | 5.8 | 5 | 2.35 | 2 | 12 | | |
| Other | 42 (2.5) | 6.3 | 6.5 | 2.22 | 1 | 11 | | |
| Missing | 42 (2.5) | 4.6 | 4.5 | 2.27 | 1 | 10 | | |
| Ethnicity | | | | | | | .01 | <.001 |
| Non-Hispanic ^c | 1,150 (67.4) | 5.9 | 6 | 2.14 | 0 | 13 | | |
| Hispanic | 487 (28.5) | 5.6 | 5 | 2.02 | 0 | 12 | | |
| Missing | 70 (4.1) | 5.5 | 5 | 2.35 | 1 | 11 | | |
| Marital status | | | | | | | <.001 | .002 |
| Single, never been married ^c | 337 (19.7) | 6.0 | 6 | 2.10 | 1 | 12 | | |
| Married/living as married | 892 (52.3) | 5.5 | 5 | 2.11 | 0 | 12 | | |
| Divorced/separated/widowed | 452 (26.5) | 6.2 | 6 | 2.02 | 1 | 13 | | |
| Missing | 26 (1.5) | 6.0 | 6 | 2.91 | 1 | 10 | | |
| Education | | | | | | | <.001 | <.001 |
| <High school ^c | 453 (26.5) | 6.2 | 6 | 2.00 | 1 | 12 | | |
| High school or equivalent | 508 (29.8) | 6.2 | 6 | 2.06 | 0 | 12 | | |
| Some college, associate, or technical training | 413 (24.2) | 5.9 | 6 | 2.07 | 0 | 13 | | |
| ≥College degree | 306 (17.9) | 4.6 | 4 | 1.99 | 0 | 11 | | |
| Missing | 27 (1.6) | 5.7 | 6 | 2.71 | 1 | 10 | | |
| Employment status | | | | | | | <.001 | <.001 |
| Unemployed ^c | 226 (13.2) | 6.5 | 6 | 2.20 | 1 | 13 | | |
| Disabled | 265 (15.5) | 6.7 | 7 | 1.95 | 1 | 11 | | |
| Employed part-time | 211 (12.4) | 5.8 | 6 | 2.06 | 0 | 12 | | |
| Employed full-time | 518 (30.4) | 5.6 | 5 | 2.03 | 0 | 12 | | |
| Homemaker | 181 (10.6) | 5.4 | 6 | 2.00 | 0 | 11 | | |
| Other/student | 79 (4.6) | 5.2 | 5 | 2.07 | 1 | 10 | | |
| Retired | 199 (11.7) | 4.8 | 5 | 1.89 | 0 | 9 | | |
| Missing | 28 (1.6) | 6.3 | 6.5 | 2.81 | 1 | 11 | | |
| How well the patient speaks English | | | | | | | .05 | .26 |
| Well ^c | 95 (5.6) | 6.3 | 6 | 2.24 | 1 | 12 | | |
| Very well | 1,142 (66.9) | 5.9 | 6 | 2.13 | 0 | 13 | | |
| Not well/Not well at all | 241 (14.1) | 5.6 | 6 | 1.81 | 0 | 11 | | |
| Missing | 229 (13.4) | 5.5 | 5 | 2.28 | 0 | 11 | | |

Note: Bold face indicates that the value is significantly different from that of the reference group ($P < .05$).

^aP values are calculated using statistical analysis that excludes the *Missing* category of each demographic variable.

^bP value adjusted to control for all other demographic factors.

^cReference value.

health behavior risk factor was poor diet (93%) as represented by low fruit and vegetable consumption, frequent fast food consumption, or frequent sugary beverage consumption. The majority of patients were

insufficiently active,²³ and about two-thirds reported feeling sleepy often or always. About one-quarter of patients reported binge drinking in the past year and tobacco use in the past 30 days. Fewer than 5%

of patients reported illegal drug use or prescription drug misuse. Stress was the most commonly reported psychosocial risk factor, followed by mild-to-severe anxiety or worry and depression. The majority of patients were overweight or obese, and almost one-half reported fair or poor overall health. After controlling for covariates, the proportion of at-risk patients differed significantly ($P < 0.05$) across practices for all factors except physical activity, drug use or prescription drug abuse, and stress.

Patient Readiness to Change and Desire to Discuss Risk Factors

Table 4 describes, for those patients who completed MOHR online ($n = 1575$), the relative frequency of patients' readiness to change risks, desire to discuss specific risk factors with their providers, and perceptions of the importance of risk factors. On average, patients were ready to change 1.2 (SD = 1.76; range, 0-9) and wanted to discuss 0.8 (SD = 1.46; range, 0-9) health risk factors with their providers. More than one-half of patients were not ready to change (56.4%) or did not want to discuss (65.3%) any risk factors with their provider. Of respondents indicating they were ready to change at least 1 risk factor ($n = 686$), the majority (69.6%) were ready to change 2 or more. Of patients indicating they wanted to discuss at least 1 risk factor ($n = 547$), just under one-half (41.3%) only wanted to discuss 1 risk and only about one-quarter (24.3%) wanted to discuss 4 or more risk factors.

Health Behaviors

Despite the high frequency of inactivity and poor diet, only about one-quarter of at-risk patients were ready to change either, independently. Only 12.8% and 11.1% of these patients, respectively, wanted to discuss either risk with their provider. Although the frequency of drug abuse or prescription misuse was relatively low, 22.2% of at-risk patients were ready to change their drug use and 20% wanted to discuss it with their provider. Of those classified as at risk for alcohol and tobacco use, 19.5% and 18.7%, respectively, wanted to change these behaviors, and 10.2% and 13.5%, respectively, wanted to discuss these risks with their providers. Fewer than 10% of patients at risk for sleep problems were ready to change or wanted to discuss sleep with their provider.

Psychosocial

About 20% of patients with high levels of stress were ready to change or wanted to discuss it with their providers. Despite the lower frequency of anxiety or worry and depression, 22.8% and 30.7% of these patients, respectively, were ready to change these fac-

tors, and 41.9% and 35.2%, respectively, wanted to discuss these issues with their providers.

General Health

About one-third (32.7%) of overweight or obese patients were ready to change their BMI. Approximately one-quarter (23.0%) wanted to discuss it with their provider. Of patients with fair or poor health status, 23.8% were ready to change and 17.3% wanted to discuss it with their provider.

Importance Ratings

Of those patients who were ready to change at least 1 risk factor ($n = 686$), the highest proportion (66.3%) identified overall health status as the most important health risk to them, followed by BMI (57.6%), and anxiety or worry (35.9%). The lowest proportion of these patients selected alcohol intake (7.0%), sugary beverage consumption (8.3%), and fast food consumption (9%) as a risk factor they were *both* ready to change and perceived as most important.

DISCUSSION

These findings provide support for implementing routine HRAs in a diverse population of patients in a range of primary care settings. The most robust finding was the consistently high number of health risks reported by patients (about 6, on average). The magnitude of differences in number of risks by patient characteristics and across practices was small to moderate, although statistically significant, and should be interpreted with caution. Even the most "advantaged" groups (white, highly educated, employed) reported an average of 4.6 risks. These risks cut across the traditional categories of physical, psychological, and behavioral health (Table 3). This presents an obvious challenge given the small amount of time available for prevention in primary care.^{10,33} It supports the need for more integrated care.^{34,35} Given that this was a general sample of primary care patients, and not the chronically ill, the high frequency of many of these risk factors (eg, poor fruit and vegetable intake, sugary beverage consumption, physical inactivity, alcohol intake, tobacco use, overweight and obesity, and poor or fair health status) relative to national prevalence estimates is of concern.²⁶⁻³² Despite the high number of health risks, most patients were not ready to change any risk factors, and few wanted to discuss risk factors with their providers. While the range of health risks included in MOHR may seem broad in terms of severity, even the risk areas of less immediate concern (eg, physical inactivity, high fast-food consumption, stress) are associated with morbidity, mortality,^{1,36} and com-

Table 3. Risk Factors per Patient and Frequency of Health Risk Factors by Practice Site

| | US Prevalence, % | All Sites | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 |
|---|---------------------|--------------|-----------|------------|------------|------------|-----------|------------|
| Respondents, No. | | 1,707 | 114 | 130 | 291 | 141 | 113 | 271 |
| Risk factors per patient, Mean (SD) | | 5.8 (2.1) | 4.3 (2.0) | 6.9 (1.9) | 6.6 (2.0) | 5.3 (2.3) | 4.2 (1.9) | 6.1 (1.8) |
| Patients "at risk" for given risk factors, No. (%) | | | | | | | | |
| Health behavior risk factors | | | | | | | | |
| Fast food | – | 975 (57.1) | 49 (43.0) | 112 (86.2) | 175 (60.1) | 63 (44.7) | 45 (39.8) | 191 (70.5) |
| Fruits and vegetables | 76.5 ²⁶ | 1,443 (84.5) | 88 (77.2) | 120 (92.3) | 241 (82.8) | 117 (83.0) | 88 (77.9) | 250 (92.3) |
| Sugary beverages | 23.9 ²⁷ | 763 (44.7) | 17 (14.9) | 110 (84.6) | 164 (56.4) | 30 (21.3) | 14 (12.4) | 148 (54.6) |
| Physical activity | 48.8 ²⁸ | 1,209 (70.8) | 73 (64.0) | 89 (68.5) | 215 (73.4) | 101 (71.6) | 71 (62.8) | 206 (76.0) |
| Sleep | – | 1,091 (63.9) | 62 (54.4) | 90 (69.2) | 199 (68.4) | 96 (68.1) | 72 (63.7) | 190 (70.1) |
| Alcohol intake | 16.9 ²⁹ | 407 (23.8) | 36 (31.6) | 45 (34.6) | 52 (17.9) | 30 (21.3) | 22 (19.5) | 62 (22.3) |
| Tobacco use | 18.1 ²⁹ | 407 (23.8) | 9 (7.9) | 45 (34.6) | 126 (43.3) | 22 (15.6) | 7 (6.2) | 68 (25.1) |
| Illegal drug use or prescription drug abuse | 9.2 ³⁰ | 55 (3.2) | 2 (1.8) | 8 (6.2) | 18 (6.2) | 5 (3.4) | 1 (0.9) | 2 (0.7) |
| Psychosocial risk factors | | | | | | | | |
| Anxiety or worry | 18.1 ³¹ | 265 (15.5) | 13 (11.4) | 31 (23.9) | 79 (27.2) | 24 (17.0) | 9 (8.0) | 20 (7.4) |
| Depression | 9.1 ³² | 146 (8.9) | 4 (3.5) | 21 (16.2) | 46 (15.8) | 13 (9.2) | 3 (2.7) | 4 (1.5) |
| Stress | – | 1,017 (59.6) | 58 (50.9) | 85 (65.4) | 197 (67.7) | 76 (53.9) | 47 (41.6) | 165 (60.9) |
| General health risk factors | | | | | | | | |
| Body mass index | 63.9 ²⁹ | 1,358 (79.6) | 64 (56.1) | 97 (74.6) | 231 (79.4) | 107 (75.9) | 80 (70.8) | 242 (89.3) |
| Overall health status | 17.1 ²⁹ | 767 (44.9) | 19 (16.7) | 42 (32.3) | 162 (55.7) | 56 (39.7) | 13 (11.5) | 94 (34.7) |

Note: All frequency values reported are the raw, unadjusted values.

^aP value adjusted for age, sex, ethnicity, marital status, education, and employment status.

Table 4. Readiness to Change, Desire to Discuss with Provider, and Importance Rating for Each Risk Factor

| Health Risk Factors | Respondents at Risk, No. | Ready to Change, No. (%) ^a | Desire to Discuss With Provider, No. (%) ^a | Rated Most Important of Factors Ready to Change, No. (%) ^b |
|---|--------------------------|---------------------------------------|---|---|
| Health behavior risk factors | | | | |
| Any dietary factor | 1,456 | 405 (27.8) | 161 (11.1) | 100/405 (24.7) |
| Fast food | 862 | 190 (22.0) | 73 (8.5) | 17/90 (9.0) |
| Fruits and vegetables | 1,321 | 361 (27.3) | 139 (10.5) | 73/361 (20.2) |
| Sugary beverages | 652 | 120 (18.4) | 48 (7.4) | 10/120 (8.3) |
| Physical activity | 1,118 | 300 (26.8) | 145 (13.0) | 86/300 (28.7) |
| Sleep | 699 | 86 (8.6) | 96 (9.6) | 14/86 (16.3) |
| Alcohol intake | 362 | 71 (19.6) | 37 (10.2) | 5/71 (7.0) |
| Tobacco use | 361 | 68 (18.8) | 49 (13.4) | 21/68 (30.9) |
| Illegal drug use or prescription drug abuse | 45 | 10 (22.2) | 9 (20) | 2/10 (20.0) |
| Psychosocial risk factors | | | | |
| Anxiety or worry | 232 | 53 (22.8) | 82 (35.3) | 19/53 (35.9) |
| Depression | 124 | 38 (30.7) | 52 (41.9) | 10/38 (26.3) |
| Stress | 930 | 209 (22.5) | 210 (22.6) | 65/209 (31.1) |
| General health risk factors | | | | |
| Body mass index | 1,260 | 420 (33.3) | 295 (23.4) | 242/420 (57.6) |
| Overall health status | 723 | 172 (23.8) | 125 (17.3) | 114/172 (66.3) |

^a The denominator for each health factor is the individuals classified as "at risk" for the factor who responded to the *Ready to Change* or *Desire to Discuss with Provider* questions (n=1,575).

^b The denominator for each health factor is the individuals classified as "at risk" for the factor who were said they were ready to change their risk for the factor; ie, the number given in the *Ready to Change* column.

| Site 7 | Site 8 | Site 9 | P Value | Adjusted P Value ^a |
|------------------|------------------|------------------|---------|-------------------------------|
| 214 5.9 (2.0) | 246 6.0 (2.0) | 187 5.4 (2.1) | <.001 | |
| 122 (57.0) | 141 (57.3) | 77 (41.2) | <.001 | <.001 |
| 180 (84.1) | 199 (80.9) | 160 (85.6) | <.001 | .003 |
| 96 (44.9) | 131 (53.3) | 53 (28.3) | <.001 | <.001 |
| 144 (67.3) | 179 (72.8) | 131 (70.1) | .11 | .34 |
| 131 (61.2) | 159 (64.6) | 92 (49.2) | <.001 | 0.01 |
| 62 (29.0) | 63 (25.6) | 35 (18.7) | .001 | .008 |
| 27 (12.6) | 70 (28.5) | 33 (17.7) | <.001 | .002 |
| 6 (2.8) | 7 (2.9) | 6 (3.2) | .03 | .25 |
| 29 (13.6) | 26 (10.6) | 34 (18.2) | <.001 | <.001 |
| 20 (9.4) | 16 (6.5) | 19 (10.2) | <.001 | <.001 |
| 137 (64.0) | 133 (54.1) | 119 (63.6) | <.001 | .080 |
| 176 (82.2) | 216 (87.8) | 145 (77.5) | <.001 | <.001 |
| 136 (63.6) | 147 (59.8) | 98 (52.4) | <.001 | <.001 |

promised quality of life,^{37,38} providing strong justification for attention to these issues.

The number and patient prioritization of health risks has several policy implications. First, if such risks are not systematically assessed, the likelihood they will be routinely identified is limited. More routine use of HRAs and patient-reported measures would align with public health goals and has the potential to increase patient-centered care and provide important information regarding patients' unmet needs.^{3,7,13}

Some practices may prefer not to know this information, given competing demands and the increasing number of issues primary care is asked to address. As with depression,³⁹ practices may only want to screen for issues they are prepared to address. Given the low number of risks patients identified as ones they were ready to change and wanted to discuss, however, the actual practice time and resource allocation may be quite manageable. Furthermore, widely available community and behavioral health care resources and programs are intended to address many risk factors assessed by MOHR. Examples include YMCA exercise programs, chronic disease self-management programs sponsored by community hospitals and nonprofit organizations, community alcohol treatment clinics,

and tobacco quit lines. Given the limited resources of many primary care practices, information on the types of risks patients most often face and their prioritization of these risks may help practices provide the most efficient services within the clinic as well as enhancing the process of linking patients to outside resources.

Still, the lack of integration within the health care system and among health care, public health, and community resources remains a central problem in service provision.^{39,40} A primary example is the present study, where no practices with co-located mental- or behavioral-health providers reported using these staff members as part of their MOHR implementation strategy.¹⁶ Thus, practices may leverage HRA findings to build the case for more integrated care and to develop stronger associations with community organizations for referral and treatment. Of course, identification and prioritization of risks are only the first steps toward an effective, integrated risk reduction system.

In an ideal setting, MOHR would be fully integrated into each clinic's electronic health record (EHR), and patient responses would automatically prompt referrals for further assessment or interventions and services within and outside of the clinic. Patients could then collaborate with their physicians or behavioral health counselors to develop action plans to self-manage these risk factors. For patients who prefer not to work with providers on such issues, this process could be automated via Web or mobile technology. Over time, many risks could be monitored using sensors and technology-supported self-management, which might include prompts to self-monitor, automated feedback, and tailoring based on progress—all this supported by timely and efficient communication between patients and practices. Self-monitoring and self-management data and data on health care, community, and technology-supported service utilization could then be linked back to the EHR so this information would be available to the physician. Specific risks could be flagged for follow-up or assessment, with action plans revised depending on progress. For now, however, MOHR data can at least guide practices in providing more relevant and efficient care to patients either through use of in-house services and partnerships or referrals to community resources.

This study has both limitations and strengths. The sample is neither random nor nationally representative. The deliberately selected diversity of clinics in terms of type, size, patient population, and geography, however, increases our confidence in the generalizability of these results.^{14,16} In addition, patients were not given the option to opt out of sharing their results with their provider, which could result in underreporting of risk factors for social desirability purposes.

Moreover, we lack detailed patient-level data regarding health history, time in current practice, and quality of patient-provider relationship. Additionally, all data are cross-sectional. Thus, we are unable to understand risk data both in the context of patients' everyday lives and in the context of the patient-provider relationship, and we cannot report on trends over time or whether administration of the MOHR tool may have affected risk over time. Finally, the high number of risk factors could be an artifact of the large number of risks assessed and the fact that all risk factors were given equal weight in these analyses. Future work could explore the value of a scoring algorithm that takes into account risk factor severity, prevalence, etc.

Study strengths include the range of practices and patients included, the robustness of the main findings about number of health risks, the pragmatic nature of the MOHR tool for both assessment and automated feedback, and the reporting on which risks patients are most ready to change and want to discuss with their provider. Future research is needed to replicate these findings in multiple settings and to develop and test pragmatic, cost-effective ways to address these health risks, both within primary care and through strong referral and linkages with community resources.

The number of health risks identified by the MOHR tool in diverse primary care patients and practices is high. Our results highlight the need for routine administration of HRAs in primary care, the importance of real-world approaches for implementing their findings and connecting patients and practices to appropriate resources, and the potential added value of including the patients' perspective in the allocation of these resources.

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REFERENCES

1. Fisher EB, Fitzgibbon ML, Glasgow RE, et al. Behavior matters. *Am J Prev Med.* 2011;40(5):e15-e30.
2. Prochaska JJ, Prochaska JM, Prochaska JO. Building a science for multiple-risk behavior change. In: Riekert KA, Ockene JK, Pbert L, eds. *The Handbook of Health Behavior Change.* 4th ed. New York, NY: Springer; 2014:245-72.
3. Glasgow RE, Kaplan RM, Ockene JK, Fisher EB, Emmons KM. Patient-reported measures of psychosocial issues and health behavior should be added to electronic health records. *Health Aff (Millwood).* 2012;31(3):497-504.
4. Agency for Healthcare Research and Quality. Health assessments in primary care: a how-to guide for clinicians and staff. <http://www.ahrq.gov/professionals/prevention-chronic-care/improve/system/health-assessments/index.html>. Published Sep, 2013. Accessed Feb, 2014.
5. US Department of Health and Human Services, Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System. <http://www.cdc.gov/brfss/questionnaires.htm>. Updated Jul 1, 2013.
6. US Department of Health and Human Services, Centers for Disease Control and Prevention. National Health Interview Survey. <http://www.cdc.gov/nchs/nhis.htm>. Updated Sep 2014.
7. Estabrooks PA, Boyle M, Emmons KM, et al. Harmonized patient-reported data elements in the electronic health record: supporting meaningful use by primary care action on health behaviors and key psychosocial factors. *J Am Med Inform Assoc.* 2012;19(4):575-582.
8. Glasgow RE, Riley WT. Pragmatic measures: what they are and why we need them. *Am J Prev Med.* 2013;45(2):237-243.
9. Stange KC, Zyzanski SJ, Jaén CR, et al. Illuminating the 'black box': a description of 4,454 patient visits to 138 family physicians. *J Fam Pract.* 1998;46(5):377-389.

10. Yarnall KS, Pollak KI, Østbye T, Krause KM, Michener JL. Primary care: is there enough time for prevention? *Am J Public Health*. 2003;93(4):635-641.
11. Stange KC, Flocke SA, Goodwin MA, Kelly RB, Zyzanski SJ. Direct observation of rates of preventive service delivery in community family practice. *Prev Med*. 2000;31(2 Pt 1):167-176.
12. The Patient Protection and Affordable Care Act, 42 USC §18001 (2010).
13. Goetzel RZ, Staley P, Ogdan L, et al; Centers for Disease Control and Prevention. A framework for patient-centered health risk assessments - providing health promotion and disease prevention services to Medicare beneficiaries. <http://www.cdc.gov/policy/ohsc/HRA/FrameworkForHRA.pdf>. Published 2011. Accessed Feb 2014.
14. Krist AH, Glenn BA, Glasgow RE, et al; MOHR Study Group. Designing a valid randomized pragmatic primary care implementation trial: the My Own Health Report (MOHR) project. *Implement Sci*. 2013;8(73):1-13.
15. Glasgow RE. What does it mean to be pragmatic? Pragmatic methods, measures, and models to facilitate research translation. *Health Educ Behav*. 2013;40(3):257-265.
16. Krist AH, Phillips S, Sabo R, et al. Adoption, reach, implementation, and maintenance of a behavioral and mental health assessment in primary care. *Ann Fam Med*. 2014;12(6):525-533.
17. Skinner HA. The drug abuse screening test. *Addict Behav*. 1982;7(4):363-371.
18. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606-613.
19. Martin A, Rief W, Klaiberg A, Braehler E. Validity of the brief patient health questionnaire mood scale (PHQ-9) in the general population. *Gen Hosp Psychiatry*. 2006;28(1):71-77.
20. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166(10):1092-1097.
21. Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. *Arch Intern Med*. 1998;158(16):1789-1795.
22. World Health Organization. Obesity: preventing and managing the global epidemic: report of a WHO consultation. Geneva, World Health Organization (WHO Technical Report Series, No. 894), 2000.
23. US Department of Health and Human Services, Centers for Disease Control and Prevention. 2008 Physical Activity Guidelines for Americans. <http://www.health.gov/paguidelines/guidelines/default.aspx>.
24. US Department of Health and Human Services. The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General. <http://www.surgeongeneral.gov/library/reports/50-years-of-progress/>. Accessed Feb 2014.
25. US Department of Health and Human Services, National Institute of Alcohol Abuse and Alcoholism. NIAAA council approves definition of binge drinking. http://pubs.niaaa.nih.gov/publications/Newsletter/winter2004/Newsletter_Number3.pdf. 2004.
26. US Department of Health and Human Services, Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Survey Data. http://www.cdc.gov/brfss/annual_data/annual_2009.htm. 2009.
27. Park S, Pan L, Sherry B, Blanck HM. Consumption of sugar-sweetened beverages among US adults in 6 states: Behavioral Risk Factor Surveillance System, 2011. *Prev Chronic Dis*. 2014;11:E65.
28. US Department of Health and Human Services, Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Survey Data. http://www.cdc.gov/brfss/annual_data/annual_2011.htm. 2011.
29. US Department of Health and Human Services, Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Survey Data. http://www.cdc.gov/brfss/annual_data/annual_2012.htm. 2012.
30. US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration. National Survey on Drug Use and Health. <http://www.samhsa.gov/data/NSDUH/2012SummNatFindDetTables/Index.aspx>. 2012. Updated Oct 2, 2013.
31. Kessler RC, Chiu WT, Demler O, Merikangas KR, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2005;62(6):617-627.
32. Centers for Disease Control and Prevention. Current depression among adults, United States, 2006 and 2008. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5938a2.htm?s_cid=mm5938a2_e%0d%0a. Oct 1, 2010.
33. Stange KC, Woolf SH, Gjeltema K. One minute for prevention: the power of leveraging to fulfill the promise of health behavior counseling. *Am J Prev Med*. 2002;22(4):320-323.
34. Kessler R, Stafford D, Messier R. The problem of integrating behavioral health in the medical home and the questions it leads to. *J Clin Psychol Med Settings*. 2009;16(1):4-12.
35. Miller BF, Mendenhall TJ, Malik AD. Integrated primary care: an inclusive three-world view through process metrics and empirical discrimination. *J Clin Psychol Med Settings*. 2009;16(1):21-30.
36. Danaei G, Ding EL, Mozaffarian D, et al. The preventable causes of death in the United States: comparative risk assessment of dietary, lifestyle, and metabolic risk factors. *PLoS Med*. 2009;6(4):e1000058.
37. Hassan MK, Joshi AV, Madhavan SS, Amonkar MM. Obesity and health-related quality of life: a cross-sectional analysis of the US population. *Int J Obes Relat Metab Disord*. 2003;27(10):1227-1232.
38. Brown DW, Balluz LS, Heath GW, et al. Associations between recommended levels of physical activity and health-related quality of life. Findings from the 2001 Behavioral Risk Factor Surveillance System (BRFSS) survey. *Prev Med*. 2003;37(5):520-528.
39. US Preventive Services Task Force. Screening for depression in adults. <http://www.uspreventiveservicestaskforce.org/uspstf/uspssaddepr.htm>. 2009. Accessed Feb 2014.
40. Lorig KR, Holman H. Self-management education: history, definition, outcomes, and mechanisms. *Ann Behav Med*. 2003;26(1):1-7.