Personal Health Behaviors are Associated with Physical and Mental Unhealthy Days: A Prescription for Health (P4H) Practice-based Research Networks Study

Desireé B. Froshaug, MS, L. Miriam Dickinson, PhD, Douglas H. Fernald, MA, and Larry A. Green, MD

Background: **Because unhealthy behaviors have been shown to predict premature mortality and quality of life is linked to chronic disease, it is plausible that there is a relationship between unhealthy behaviors and a patient's overall well-being.**

Methods: **Baseline data from the Robert Wood Johnson Foundation's Prescription for Health initiative were used. Using various methods, 9 practice-based research networks collected common data about cigarette smoking, diet, exercise, and perceived physical and mental health from 5358 patients from 67 practices. Multilevel ordinal regression modeling was used to examine the relationship between risk behaviors and physical or mental unhealthy days.**

Results: **Smoking, unhealthy diet, and inactivity were associated with more self-reported unhealthy days after adjusting for clustering and significant covariates. Smoking was associated with increased odds of more unhealthy days (odds ratio [OR], 1.51; $P < .0001$), as was a poor diet (OR, 1.10; $P < .0001$). More exercise (OR, 0.96; $P = .0005$) was associated with decreased odds of physical or mental unhealthy days.**

Conclusion: **Unhealthy patient behaviors were associated with increased odds of physical or mental unhealthy days, suggesting a further reason primary care clinicians should address behavior change with patients. Implementing a brief, 2-question, quality of life screening would target groups of primary care patients with a higher prevalence of unhealthy behaviors. (J Am Board Fam Med 2009;22:368–74.)**

Unhealthy behaviors contribute to the burden of morbidity and mortality from acute and chronic diseases, highlighting the importance of addressing personal behaviors in the primary care medical setting. America's number one killer—heart disease[1]— and the current obesity epidemic[2] are largely preventable through improving modifiable behaviors, including regular exercise, healthy dietary habits, and not smoking.[3] In 2006 the Centers for Disease Control and Prevention (CDC) reported that just over one fifth of the US population were current smokers,[4] causing more than 400,000 deaths a year and costing the US approximately $75 billion each year in health care.[5,6] Furthermore, recent reports indicate that more than three quarters (76.8%) of Americans do not eat the recommended 5 fruits and vegetables a day and more than 22% did not participate in any physical activity in the past 30 days.[7] Cigarette smoking, risky drinking of alcohol, physical inactivity, and unhealthy dietary practices accounted for 900,000 preventable deaths (39%) in 2000.[3,6] Slightly more than 90% of the US population engage in at least 1 of the above-mentioned unhealthy behaviors[3,8–10] whereas an estimated 43% have at least 2 risky behaviors.[6]

Parallel to the patterns of unhealthy patient behaviors is the proportion of people with ≥14 self-reported physical or mental unhealthy days in the

This article was externally peer reviewed.
Submitted 17 July 2008; revised 9 September 2008; accepted 12 September 2008.
From the Department of Family Medicine, University of Colorado Denver and the Prescription for Health National Program Office, Aurora, Colorado.
Funding: Preparation of this article was supported by The Robert Wood Johnson Foundation, grant number 48433.
Conflict of interest: none declared.
Corresponding author: Desireé B. Froshaug, MS, Department of Family Medicine, University of Colorado Denver, A01 L-15 Mail Stop F496, Aurora, CO 80045 (E-mail: desiree.froshaug@gmail.com).

See Related Commentary on Page 352.

J Am Board Fam Med: first published as 10.3122/jabfm.2009.04.080150 on 8 July 2009. Downloaded from http://www.jabfm.org/ on 9 October 2026 by guest. Protected by copyright.

past month, which increased from 15% in 1993 to 18% in 2001. Those with no overall unhealthy days in the past 30 decreased from 51% to 48% over the same period.[11] These trends toward poorer health suggest a need for a focus on unhealthy behaviors in primary care, especially with current attention toward whole-person, patient-centered care as exemplified by the medical home.[12]

The relationship between unhealthy behaviors and preventable disease is well documented, and the relationship between sociodemographic characteristics and self-reported health-related quality of life (HRQOL) has been examined.[8,11,13–15] However, the relationship between unhealthy behaviors and HRQOL is less understood, especially among primary care populations. Although exploration of the relationship between risk behaviors and various components of HRQOL have been conducted in surveillance settings and targeted populations (eg, specific states, adolescents, specific chronic diseases),[9,16–18] investigations in multiple diverse primary care settings are lacking.

Funded by the Robert Wood Johnson Foundation, the Prescription for Health initiative (P4H) was launched to identify, test, and evaluate techniques to improve the delivery and effectiveness of health behavior change strategies in primary care practices by targeting 4 risk behaviors associated with premature death and morbidity: smoking tobacco, risky alcohol drinking, eating patterns, and physical inactivity.[19,20] The P4H initiative provided an opportunity to assess whether or not unhealthy behaviors of adult primary care patients were associated with self-reported number of physical or mental unhealthy days. Our hypothesis was that unhealthy behaviors would be positively associated with patients reporting increased numbers of unhealthy days.

Methods

Design

Ten practice-based research networks (PBRNs) participated in the second round of P4H, and 9 collected adult data.[20,21] A predetermined set of measures, identified by the Common Measures, Better Outcomes (COMBO) study team, was administered to patients in all P4H PBRN practices.[20,22] In addition, practice characteristics were collected using standardized surveys.[23] Each PBRN developed its own approach to addressing unhealthy behaviors and study design. Each network performed its own practice and patient recruitment, data collection, and preparation of data files. The program did not prescribe selection criteria for practice or patient enrollment, instead allowing projects to use criteria suitable to their intervention designs. The de-identified common patient data measures were delivered to the P4H National Program Office for further merging, cleaning, and analysis between August 2005 and January 2007. This study was approved by the University of Colorado Denver human subjects review board, and all of the projects were also approved by their respective human subjects review boards.[20]

Independent Variables

Based on previous work by Glasgow et al[22] and feedback from the PBRNs, a set of 21 questions comprised the adult assessment tool for the health behaviors. Criteria for selecting these measures included sensitivity to change, brevity, breadth of applicability, relationship to public health goals, and validation in English and Spanish. All questions were available in English or Spanish. Demographic characteristics included gender, age, height, weight, income, and education, as done in the Behavioral Risk Factor Surveillance System.[19]

Those who smoked at least 100 cigarettes in their lifetime and smoked within the past 30 days were considered a current smoker. The diet instrument "Starting the Conversation"[22] asked about 7 food habits: intake of fast food, fruits/vegetables, sweet drinks, protein, chips/crackers, desserts, and fats. Because each response was a categorized range of consumption, ordinal values were assigned to each response. Summing the values provided a score of 0 to 14, where 14 represented the least healthy diet habits. Imputation for up to 2 of the 7 missing dietary questions was implemented, substituting the mean of the completed responses for that individual.[24] The International Physical Activity Questionnaire (short version) was used to measure physical activity through MET-minutes, a continuous, universal, weighted sum of exercise per week.[25]

Outcome

Patients' perceived HRQOL was captured through the CDC's Healthy Days core measures (HRQOL-4). The HRQOL-4 measures have proved to be valid, reliable, responsive to change, and consis-

J Am Board Fam Med: first published as 10.3122/jabfm.2009.04.080150 on 8 July 2009. Downloaded from http://www.jabfm.org/ on 9 October 2026 by guest. Protected by copyright.

tent.[26] Although all 4 questions offer insight into the respondents' HRQOL, the second and third questions comprised the self-reported HRQOL measure used in this analysis. These questions ask separately about the number of days of the past 30 during which the respondents felt physical or mental illness or injury. Summing and truncating at 30 days, as described by the CDC's guidelines, provided the overall unhealthy days outcome. The resulting distribution of the primary outcome variable was bimodal, with peaks at the lower and upper values of 0 and 30 unhealthy days, respectively. The outcome was categorized into a 3-level ordinal outcome for analysis, as previously reported: 0 unhealthy days, 1 to 13 unhealthy days, and 14 to 30 unhealthy days.[11]

Statistical Analyses

Participants who did not answer the physical or mental unhealthy days question, thus missing the outcome of overall unhealthy days, were eliminated from the final analyses. Similarly, patients with missing significant independent variables (ie, risk behaviors or demographics) were eliminated from the analysis. Demographic variables that had more than 5% missing data were analyzed with an additional category of nonrespondents, retaining as many patients as possible in the analysis. Comparisons of the patients included in the analysis with those excluded were done by *t* tests and χ^2 tests.

To test the primary hypothesis that specific risk behaviors were positively associated with patients' category of unhealthy days, multilevel proportional odds ordinal regression modeling was conducted using PROC NLMIXED in SAS software version 9.1 (SAS Institute Inc., Cary, NC). A cumulative logit model with categories of 0 days, 1 to 13 days, and 14 to 30 days was used in the ordinal regression analysis, estimating the log odds of being in a *lower* category of unhealthy days (fewer unhealthy days) versus a *higher* category while adjusting for the clustering of patients within practices. Further model development investigated and included patients' sociodemographic characteristics and practice characteristics for which adjustment was needed in the final analysis to control for potential confounders, mediators, or moderators. Patient covariates that were either clinically significant or univariately significant at $P < .2$ were included in the model. Similarly, practice covariates were included if statistically significant at $P < .1$, after adjusting for clustering, the risk behaviors, and patient covariates. Continuous covariates were centered at their mean to increase interpretability: age was centered at 50, diet score was centered at 5.6, and the MET-minutes were centered at the average of 2308 and divided by 1000.

Results

Study Population

The COMBO baseline data of 5358 adult patients were merged from 9 PBRNs and a total of 67 primary care practices.[20] Of these patients, 1620 had missing data on one or more necessary predictors or the outcome; thus, 3738 patients from 64 practices were used to develop the final model. Comparisons of those included versus excluded in the analyses are shown in Table 1. Overall, patients were mostly women (71.7%) and non-Hispanic whites (60.2%), 80.2% had a high school education (or GED) or greater, and 47.1% reported an annual household income of $25,000 or more. Patients who were excluded from the analysis because of missing data were older, less educated, less likely to be overweight, and had lower incomes than those included in the analysis.

Results of the multilevel proportional odds ordinal regression analyses are shown in Table 2. Odds ratios (OR) adjusted for clustering and significant practice and patient covariates reflect the odds of being in a *higher* category of unhealthy days versus a *lower* category.

Patient Risk Behaviors

Univariate analyses showed that the risk behaviors (smoking, poor diet, and lack of exercise) were all significantly associated with an increased number of unhealthy days. All 3 risk behaviors remained highly significant after adjusting for patient and practice covariates and the clustering of patients within practices. Smoking was associated with increased odds of having more unhealthy days (OR, 1.51), as was a worse (higher) diet score (OR, 1.10 per every 1 unit increase), whereas increased exercise was associated with decreased odds of unhealthy days (OR, 0.96 per 1000 MET-minute increase).

Covariates

Patient characteristics that were significantly associated with increased overall unhealthy days included being a women ($P < .0001$), younger ages

J Am Board Fam Med: first published as 10.3122/jabfm.2009.04.080150 on 8 July 2009. Downloaded from http://www.jabfm.org/ on 9 October 2026 by guest. Protected by copyright.

Table 1. Comparison of Patient Characteristics for Those Included Versus Those Excluded[20]

Patient Characteristics	Included in Analysis (n = 3738)	Excluded from Analysis (n = 1620)	*P*	Total (n = 5358)
Risk behaviors				
Current smokers (n [%])	920 (24.61)	370 (25.22)	.6468	1290 (24.78)
Diet score (mean [SD])	5.66 (2.57)	5.58 (2.54)	.2854	5.64 (2.56)
MET-minutes (mean [SD])	2356 (3202)	2145 (2916)	**.0407**	2308 (3141)
Gender (n [%])			**.0009**	
Men	1010 (27.02)	498 (31.50)		1508 (28.35)
Women	2728 (72.98)	1083 (68.50)		3811 (71.65)
Age (years) (mean [SD])	48 (16.00)	55 (17.00)	**<.0001**	50 (16.60)
Race/ethnicity (n [%])			.1889	
Non-Hispanic white	2229 (61.09)	883 (58.21)		3112 (60.24)
Non-Hispanic black	612 (16.77)	278 (18.33)		890 (17.23)
Hispanic/Latino	631 (17.29)	287 (18.92)		918 (17.77)
Other	177 (4.85)	69 (4.55)		246 (4.76)
Education (n [%])			**<.0001**	
<High school	457 (12.23)	321 (19.81)		778 (14.52)
High school graduate or GED	982 (26.27)	466 (28.77)		1448 (27.03)
>High school	2174 (58.16)	674 (41.60)		2848 (53.15)
No response	125 (3.34)	159 (9.81)		284 (5.30)
Income (per year) (n [%])			**<.0001**	
<$25,000	1373 (36.76)	686 (42.35)		2059 (38.43)
$25,000–$49,999	850 (22.74)	321 (19.81)		1171 (21.86)
≥$50,000	995 (26.62)	359 (22.16)		1354 (25.27)
No response	520 (13.91)	254 (15.68)		774 (14.45)
Body mass index (mean [SD])	31.09 (8.09)	29.98 (7.42)	**<.0001**	30.76 (7.92)
Overall unhealthy days (n [%])			.4445	
0	1017 (27.21)	228 (28.97)		1245 (27.51)
1–13	1432 (38.31)	284 (36.09)		1716 (37.92)
≥14	1289 (34.48)	275 (34.94)		1564 (34.56)
Physically unhealthy days (n [%])			**<.0001**	
0	1586 (42.43)	401 (35.64)		1987 (40.86)
1–13	1384 (37.03)	449 (39.91)		1833 (37.69)
≥14	768 (20.55)	275 (24.44)		1043 (21.45)
Mentally unhealthy days (n [%])			.0999	
0	1692 (45.26)	445 (48.11)		1987 (45.83)
1–13	1236 (33.07)	272 (29.41)		1833 (32.34)
≥14	810 (21.67)	208 (22.49)		1043 (21.83)

Bolded values signify $P < 0.05$.

($P < .0001$), and low household incomes (<$25,000 per year) ($P < .0001$); race/ethnicity was marginally significant ($P = .0672$, overall). Of a multitude of practice characteristics thought to be clinically important, those found to be statistically significantly associated with the ordinal outcome categories of unhealthy days were clinic ownership, in favor of hospital owned ($P = .001$ overall) compared with private clinician-owned practices; marginally significant was the presence of a registry ($P = .0782$).

Discussion

The main finding of this study was that primary care patients' cigarette smoking, unhealthy diets, and physical inactivity were directly associated with increased self-reported physical or mental unhealthy days. This association persisted after adjusting for significant patient and practice covariates and the clustering of patients within practices. These findings are similar to those from recent surveillance studies or analyses performed in other targeted populations.[9,16,27–33] Similarly, patients

J Am Board Fam Med: first published as 10.3122/jabfm.2009.04.080150 on 8 July 2009. Downloaded from http://www.jabfm.org/ on 9 October 2026 by guest. Protected by copyright.

Table 2. The Relationship Between Unhealthy Days and Risk Behaviors: a Multilevel Ordinal Regression Model[20] (n = 3738)

	ML Estimate	Standard Error	*t* Test Score	*P*	Adjusted Odds Ratio (95% CI)
Threshold 2*	1.7919	0.0423	42.37	**<.0001**	
Intercept	0.6137	0.1245	4.93	**<.0001**	1.00 (1.00)
Patient risk behaviors					
Smoking	0.4148	0.0759	5.47	**<.0001**	1.51 (1.30, 1.76)
Diet Score[†‡]	0.0966	0.0128	7.56	**<.0001**	1.10 (1.07, 1.13)
Exercise MET minutes[‡]	-0.0375	0.0102	-3.70	**.0005**	0.96 (0.94, 0.98)
Patient demographics					
Age[‡]	-0.0105	0.0022	-4.83	**<.0001**	0.99 (0.99, 0.99)
Female	0.3367	0.0741	4.55	**<.0001**	1.40 (1.21, 1.62)
African-American[§]	-0.1315	0.0916	-1.44	.1559	0.88 (0.73, 1.05)
Hispanic[§]	-0.2318	0.1084	-2.14	**.0363**	0.79 (0.64, 0.98)
Low income	0.5867	0.0759	7.73	**<.0001**	1.80 (1.55, 2.09)
Practice characteristics					
Registry[‖]	-0.2045	0.1142	-1.79	.0782	0.82 (0.65, 1.02)
University owned	0.4389	0.1491	2.94	**.0045**	1.55 (1.16, 2.08)
Hospital owned	-0.0214	0.1056	-0.20	.8397	0.98 (0.80, 1.20)
Other	0.4849	0.1697	2.86	**.0058**	1.62 (1.16, 2.26)

Bolded values signify $P < 0.05$.
*With intercept plus coefficients, model estimates log odds (ML estimate) of having 0 unhealthy days as opposed to 1–30 unhealthy days. The addition of threshold 2 to the log odds estimates log odds of having 0–13 unhealthy days compared to 14–30 unhealthy days.
[†]Ranging 0–14, where 0 is best and 14 is worst diet.
[‡]Centered at the mean of the sample.
[§]Compared with non-Hispanic whites.
[‖]Compared with private clinician-owned.

with a healthy diet and more physical activity reported fewer unhealthy days per month, consistent with the results of previous studies in different populations.[27,28,30–32] In addition, the continuous measures of exercise and diet demonstrated a dose-response relationship with the ordinal categories of unhealthy days in the expected direction (data not shown), supporting a possible causal relationship between poor diet and exercise habits and more overall self-reported unhealthy days. Further investigations using longitudinal methods are needed to determine whether the causal relationship suggested by these results, is a legitimate conclusion.

Compared with Behavioral Risk Factor Surveillance System data, our sample was generally poorer and more likely to be minority and women.[20] Despite the decreased odds of co-occurrence of multiple risk behaviors among women compared with men,[3] women tended to report more overall unhealthy days than men, corroborating other studies.[8,11] The strong association between unhealthy days and low household income (<$25,000 per year) was striking and also similar to previous studies.[8,11,16] It is interesting that increasing age in this group of primary care patients was associated with decreased odds of unhealthy days. Perhaps patients' perspectives of unhealthy days change as they grow older, or it is possible that these measures perform differently in older age groups. It was also notable in our study that Hispanic ethnicity was significantly associated with fewer unhealthy days.

These results are timely because of changes being made in the way primary care is delivered. Some primary care practices are implementing and adapting registries for chronic diseases and systematically tracking quality of life could be monitored as well. Our findings raise the possibility that collecting patients' opinions about only 2 HRQOL questions could provide as efficient an approach, serving the additional function of identifying patients likely to need attention to unhealthy, changeable behaviors. Furthermore, routine assessment of a person's HRQOL would be consistent with a patient-centered approach as envisioned by the patient-centered medical home.

J Am Board Fam Med: first published as 10.3122/jabfm.2009.04.080150 on 8 July 2009. Downloaded from http://www.jabfm.org/ on 9 October 2026 by guest. Protected by copyright.

This study has several limitations. First, the data were cross-sectional, thus causality cannot be inferred although the observed dose-response relationship for diet and exercise supports a possible cause and effect relationship. Second, we could not adjust our findings for possible comorbidities because the survey instruments used did not assess them. Third, these analyses are based on self-reported data, making them subject to reporting biases. However, a person's perspective of their own health is a valid measure of his or her quality of life. In addition, the patients in our study, although likely similar to primary care patients, were not a representative sample; those excluded from the analysis because of missing data were significantly less educated and had lower incomes, limiting generalizability. Finally, this study cannot determine whether poor health preceded or followed unhealthy behaviors, suggesting an area worthy of further investigation.

Conclusion

In "real-world" primary care practice settings, patients' unhealthy behaviors were associated with poorer quality of life, providing another reason why primary care practices should address health behaviors. Using only 2 questions regarding a patient's perceived mental and physical health could offer primary care providers a practical and efficient way to routinely assess the ultimate goal of health care: maintaining or improving a patient's quality of life. The use of these quality of life measures is also likely to help identify patients who may need some help with behaviors known to predict premature death and avoidable suffering. Thus, routine use of HRQOL measures in primary care merits further consideration and study, particularly as an element of the emerging medical home.

We gratefully acknowledge the input and feedback provided by Maribel Cifuentes, RN, BSN; Diane Fairclough, PhD; and Gary Grunwald, PhD.

References

1. Centers for Disease Control and Prevention (CDC). Prevalence of heart disease–United States, 2005. MMWR Morb Mortal Wkly Rep 2007;56:113–8.
2. Mokdad AH, Serdula MK, Dietz WH, Bowman BA, Marks JS, Koplan JP. The spread of the obesity epidemic in the United States, 1991–1998. JAMA 1999;282:1519–22.
3. Fine LJ, Philogene GS, Gramling R, Coups EJ, Sinha S. Prevalence of multiple chronic disease risk factors. 2001 National Health Interview Survey. Am J Prev Med 2004;27(2 suppl):18–24.
4. Safran DG. Defining the future of primary care: what can we learn from patients? Ann Intern Med 2003;138:248–55.
5. American Lung Association. Search LungUSA. Available at http://www.lungusa.org/site/apps/s/search.asp?c=dvLUK9O0E&b=4061173. Accessed 29 January 2008.
6. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. JAMA 2004;291:1238–45.
7. Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System prevalence and trends data. Available at http://apps.nccd.cdc.gov/brfss/. Accessed 20 June 2007.
8. Centers for Disease Control and Prevention. Health-related quality of life Measuring Healthy Days monograph. Available at http://www.cdc.gov/hrqol/monograph.htm. Accessed 6 June 2007.
9. Li C, Ford ES, Mokdad AH, Jiles R, Giles WH. Clustering of multiple healthy lifestyle habits and health-related quality of life among US adults with diabetes. Diabetes Care 2007;30:1770–6.
10. Pronk NP, Anderson LH, Crain AL, et al. Meeting recommendations for multiple healthy lifestyle factors: prevalence, clustering, and predictors among adolescent, adult, and senior health plan members. Am J Prev Med 2004;27(2 Suppl 1):25–33.
11. Zahran HS, Kobau R, Moriarty DG, et al. Health-related quality of life surveillance–United States, 1993–2002. MMWR Surveill Summ 2005:54:1–35.
12. The Robert Graham Center. The patient centered medical home: history, seven core features, evidence and transformational change (2007). Available at http://www.graham-center.org/PreBuilt/PCMH.pdf. Accessed 14 February 2008.
13. Zack MM, Moriarty DG, Stroup DF, Ford ES, Mokdad AH. Worsening trends in adult health-related quality of life and self-rated health–United States, 1993–2001. Public Health Rep 2004;119:493–505.
14. Centers for Disease Control and Prevention (CDC). Community indicators of health-related quality of life–United States, 1993–1997. MMWR Morb Mortal Wkly Rep 2000; 49:281–5
15. Centers for Disease Control and Prevention (CDC). Health-related quality of life–Los Angeles County, California, 1999. MMWR Morb Mortal Wkly Rep 2001;50:556–9.
16. Strine TW, Okoro CA, Chapman DP, et al. Health-related quality of life and health risk behaviors among smokers. Am J Prev Med 2005;28:182–7.
17. Jiang Y, Hesser JE. Associations between health-related quality of life and demographics and health risks. Results from Rhode Island's 2002 behavioral

J Am Board Fam Med: first published as 10.3122/jabfm.2009.04.080150 on 8 July 2009. Downloaded from http://www.jabfm.org/ on 9 October 2026 by guest. Protected by copyright.

risk factor survey. Health Qual Life Outcomes 2006; 4:14.
18. Topolski TD, Patrick DL, Edwards TC, Huebner CE, Connell FA, Mount KK. Quality of life and health-risk behaviors among adolescents. J Adolesc Health 2001;29:426–35.
19. Cifuentes M, Fernald DH, Green LA, et al. Prescription for health: changing primary care practice to foster healthy behaviors. Ann Fam Med 2005; 3(Suppl 2):S4–11.
20. Fernald DF, Froshaug DB, Dickinson LM, et al. Common measures, better outcomes (COMBO): a field test of brief health behavior measures in primary vare: results from the COMBO study. Am J Prev Med 2008;35(5 Suppl):S414–22.
21. Prescription for Health. Prescription for Health Innovators. Available at http://www.prescriptionforhealth.org/grantees/index.html. Accessed 18 November 2008.
22. Glasgow RE, Ory MG, Klesges LM, Cifuentes M, Fernald DH, Green LA. Practical and relevant self-report measures of patient health behaviors for primary care research. Ann Fam Med 2005;3:73–81.
23. Hung DY, Glasgow RE, Dickinson LM, et al. The chronic care model and relationships to patient health status and health-related quality of life. Am J Prev Med. 2008;35(5 Suppl):S398–406.
24. Gaskins ND, Sloane PD, Mitchell CM, Ammerman A, Ickes SB, Williams CS. Poor nutritional habits: a modifiable predecessor of chronic illness? A North Carolina Family Medicine Research Network (NC-FM-RN) study. J Am Board Fam Med 2007;20:124–34.
25. Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003;35: 1381–95.
26. Moriarty DG, Kobau R, Zack MM, Zahran HS. Tracking healthy days—a window on the health of older adults. Prev Chronic Dis. 2005;14:377–89.
27. Steptoe A, Perkins-Porras L, Hilton S, Rink E, Cappuccio FP. Quality of life and self-rated health in relation to changes in fruit and vegetable intake and in plasma vitamins C and E in a randomised trial of behavioural and nutritional education counselling. Br J Nutr 2004;92:177–84.
28. Keller HH, Østbye T, Goy R. Nutritional risk predicts quality of life in elderly community-living Canadians. J Gerontol A Biol Sci Med Sci 2004;59:68–74.
29. 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;37:520–8.
30. Department of Health and Human Services. Physical Activity and Health: a report of the Surgeon General. Atlanta (GA): US Department of Health and Human Services, Centers for Disease Control and Prevention; 1996.
31. Kant AK, Schatzkin A, Graubard BI, Schairer C. Dietary patterns predict mortality in a national cohort: the National Health Interview Surveys, 1987 and 1992. J Nutr 2004;134:1793–9.
32. Bish CL, Blanck HM, Maynard LM, Serdula MK, Thompson NJ, Khan LK. Health-related quality of life and weight loss practices among overweight and obese US adults, 2003 behavioral risk factor surveillance system. MedGenMed 2007;9:35.
33. Vidrine DJ, Arduino RC, Gritz ER. The effects of smoking abstinence on symptom burden and quality of life among persons living with HIV/AIDS. AIDS Patient Care STDS 2007;21:659–66.

J Am Board Fam Med: first published as 10.3122/jabfm.2009.04.080150 on 8 July 2009. Downloaded from http://www.jabfm.org/ on 9 October 2026 by guest. Protected by copyright.