Published in final edited form as:

J Am Geriatr Soc. 2011 February ; 59(2): 370–372. doi:10.1111/j.1532-5415.2011.03258.x.

MULTIPLE HEALTH BEHAVIORS AND MORTALITY RISK IN OLDER ADULTS

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To the Editor: An accumulating body of evidence has demonstrated the health benefit of certain behaviors, including moderate physical activity,¹ not -smoking,² low to moderate alcohol intake,³ and consumption of fruit and vegetables.⁴ Despite this, adherence to a healthy lifestyle pattern has decreased during the last 18 years.⁵ Because multiple health risk behaviors are known to cluster, the effect of combined health behavior on health outcomes may be important. This research may be helpful to inform policy-makers about the efficacy of multibehavior interventions as opposed to single-behavior interventions, but there is limited information about the effects of combined health behaviors on mortality in representative samples of older adults, which formed the rationale for the present study.

Data were derived from the National Diet and Nutrition Survey (NDNS) of people living in the community aged 65 and older from mainland Britain.⁶ Ethical approval for the survey was obtained from the local research ethics committees for each of the 80 randomly-selected post code sectors included in the survey (20 per “wave”) and from the Ethics Committee of the Medical Research Council (MRC) Dunn Nutrition Unit. The survey was linked to National Health Service administrative mortality data up to September 2008. Self-reported physical activity, smoking, and alcohol use were recorded. Plasma vitamin C was used as a marker of plant food intake, with a value of 50 mU or greater used to indicate daily intake of at least five servings of fruit and vegetables, as previously defined.⁷ This measure was verified against estimated vitamin C intake from a 4-day weighed food record.⁶ A combined health behavior score was derived by giving 1 point for each of the following: nonsmoking, moderate alcohol consumption (1–21 units for men, 1–14 units for women), regular moderate to vigorous physical activity, and vitamin C (≥ 50 mU). Thus, the combined health behavior scores ranged from 0 to 4.

The survey response rate was 85%; from the eligible sample of 2,172 participants, 72% provided full interview data and 59% provided full diet records. The present analysis consisted of 1,062 participants (539 men, 523 women, mean age, 76.5 ± 7.5, range 65–99) who consented to follow-up. Approximately 15.0% of the sample adhered to all four behaviors. Participants adhering to more healthy behaviors were younger, more likely to be female, and more highly educated and had better self-rated health. There were 714 all-cause

Author Contributions: All authors were responsible for the study concept and design, interpretation of data, drafting and critical revision of the manuscript. GDM and CJB: acquisition of data. MH: statistical analysis and preparation of the data. All authors approved the final version of the article. MH is the guarantor.

Conflict of Interest: None of the authors have any competing interests to declare.

deaths over an average of 9.2 years of follow-up. The results demonstrate a linear inverse association between the combined health behavior score and mortality risk, which persisted after adjustment for possible confounding factors (Table 1). All of the individual health behaviors were associated with lower risk of mortality: physical activity (multivariate-adjusted hazard ratio (HR)=0.83, 95% confidence interval (CI)=0.69–1.00), smoking (HR=0.73, 95% CI=0.59–0.90), moderate alcohol (HR=0.81, 95% CI=0.70–0.94), and vitamin C intake of 50 mU or greater (HR=0.88, 95% CI=0.74–1.05). None of the health behaviors individually was as powerful as the combined effects, which lowered the all-cause mortality rate 58%. When estimated dietary vitamin C intake was used instead of plasma vitamin C, the results were identical when using a cut-point of 40 mg/d to represent the U.K. recommended intake.

The present study demonstrated that adherence to healthy behaviors, including not smoking, moderate alcohol consumption, regular moderate to vigorous physical activity, and adequate vitamin C intake (a marker of fruit and vegetable consumption) was associated with lower risk of mortality in a representative sample of older participants from the United Kingdom. Approximately 15% of the sample met the criteria for all four healthy behaviors, which is comparable with a German cohort, in which 9% met the same criteria.⁸ Although a number of previous studies have examined associations between combined health behavior and disease end points, far less work has specifically considered the elderly population. In a cohort of elderly European men and women, adherence to the four key health behaviors lowered all-cause mortality 65%,⁹ which is similar to the results of the current study, which demonstrate a 51% lower risk after adjustment for possible confounders. In the Cardiovascular Health Study, the rate of incident diabetes mellitus was 35% lower for each additional low-risk lifestyle factor in participants aged 65 and older.¹⁰

Strengths of the present study include the nationally representative sample of community-dwelling adults, the prospective design, and the rigorous methods of outcome ascertainment. The exposure measures were based on self-report, which represents a limitation. In summary, healthy behaviors confer benefit for survival in older adults.

Acknowledgments

We are indebted to Claire Deverill and Marie Sanchez (National Centre for Social Research (NatCen)) for assistance in obtaining the mortality data.

The survey was commissioned jointly by the Department of Health and the Ministry of Agriculture, Fisheries and Food, whose survey responsibility has since been transferred to the Food Standards Agency. It was conducted by the NatCen, formerly Social and Community Planning Research in conjunction with the Micronutrient Status Laboratory of the MRC Dunn Nutrition Unit, now part of MRC Human Nutrition Research. The survey datasets were obtained from the survey commissioners, the University of Essex Data Archive and the Social Survey Division of the Office for National Statistics, and funding was also provided by the MRC.

Sponsor's Role: The funding organizations played no role in the design or conduct of the study; collection, management, analysis, or interpretation of the data; or preparation, review, or approval of the manuscript.

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Table 1

Cox Proportional Hazards Models for the Association Between Combined Health Behavior and Mortality over 9 Years of Follow-Up

Combined Score	Deaths, n/N	Hazard Ratio (95% Confidence Interval)	
		Age and Sex Adjusted	Fully Adjusted
All-cause mortality	714/1,062		
1	144/166	1.00	1.00
2	281/400	0.63 (0.51–0.77)	0.67 (0.55–0.83)
3	207/337	0.56 (0.45–0.69)	0.63 (0.50–0.78)
4	82/159	0.42 (0.32–0.55)	0.49 (0.37–0.65)
P-value for trend		<.001	<.001
Cardiovascular disease mortality	193/1,062		
1	36/166	1.00	1.00
2	77/400	0.69 (0.46–1.03)	0.76 (0.51–1.15)
3	57/337	0.61 (0.40–0.93)	0.72 (0.47–1.12)
4	23/159	0.47 (0.28–0.80)	0.60 (0.35–1.03)
P-value for trend		.03	.29
Cancer mortality	137/1,062		
1	28/166	1.00	1.00
2	50/400	0.63 (0.40–1.00)	0.66 (0.41–1.05)
3	44/337	0.61 (0.38–0.98)	0.65 (0.40–1.07)
4	15/159	0.38 (0.20–0.71)	0.42 (0.22–0.81)
P-value for trend		.02	.07

Full model contains adjustment for: age, sex, education (GSE or none), self-rated health (very good, good, fair, poor or bad), body mass index.