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Health-related behaviors and perceptions among physicians: Results from a cross-sectional study

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What is already known about this subject?

- Physicians work in emotionally charged and stressful situations, dedicating long weekly hours to their work. Their demanding work conditions may reduce the time and energy required for maintaining healthy lifestyles.

What are the new findings?

- Residents and hospital physicians reported significantly less healthy lifestyles, lower perceived health status, and higher levels of stress, compared with senior and community physicians.

- Poor nutrition, not meeting physical activity targets, inadequate sleep and perceived poor health status explained physicians' high stress levels.

How might this impact on policy or clinical practice in the foreseeable future?

- Our findings point to the urgent need for an intervention program to help physicians adopt healthier lifestyles.

- Interventions should include education of medical students and physicians on healthy lifestyle and practical tools for implementing and maintaining it as well as providing physicians' workplaces with health promoting environments.

Abstract

Objectives: Physicians who practice healthy lifestyles have been found to be more effective in promoting preventive healthy behaviors among patients; however, their demanding work conditions may reduce the time and energy required for maintaining healthy lifestyles. This study examined health-related behaviors, perceived health status and emotional stress among physicians, and analyzed the effects of personal and work characteristics on these endpoints.

Methods: During 2015, digital questionnaires were emailed to all 25,590 members of the Israeli Medical Association. Uni- and multivariate analyses were performed.

Results: Of 14,694 physicians who opened the email, 4,832 (32.9%) responded. Of the total respondents, 21% reported poor or fair health status, 36% felt considerable emotional stress, 57% were overweight or obese (according to body mass index $\geq$25 kg/m^2), 29% met recommended physical activity level, 21% met a composite measure of healthy nutrition, 8% were current smokers, 25% slept 5 hours or less, and 43% had a regular physician. Residents and hospital physicians reported significantly less healthy lifestyles, lower perceived health status, and higher levels of stress, compared with senior and community physicians. Multivariable analysis demonstrated that being female (OR=0.74, CI=0.64-0.85), younger (0.69, 0.64-0.74), having poor nutrition (0.66, 0.55-0.78), not meeting physical activity targets (0.68, 0.57-0.82), inadequate sleep (0.54, 0.40-0.56), and perceived poor health status (0.48, 0.40-0.56) explained high stress levels with statistical significance (p<0.001).

Conclusions: The unfavorable health behaviors reported among Israeli physicians may have negative effects on their health and well-being. An intervention program to help physicians adopt healthier lifestyle is urgently needed.

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Strengths and limitations of the study

<u>**Strengths**</u>

- This national study portrayed the health behaviors of a relatively large number of respondents (n=4,832), the largest of its kind in Israel.

- The finding that poor nutrition, not meeting physical activity targets and inadequate sleep explained physicians' high stress levels might create the basis for interventions to reduce stress and possibly also reduce burnout among physicians.

<u>**Limitations**</u>

- A digital survey dictated a relatively short questionnaire, not allowing to include important topics such as performing screening tests as recommended.

- A response rate of 33% is a barrier to generalizing the findings to a larger physician population.

- Physicians who felt more positive about their health behaviors could be more likely to respond to the survey. If this was in fact the case, then the actual health status of the physicians would be worse than that described.

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INTRODUCTION

Non-communicable diseases, comprising mainly cardiovascular diseases, diabetes, cancer and chronic respiratory diseases, are the leading causes of death globally, accounting for 68% of deaths in 2012.[1] The prevalence of lifestyle-related diseases, such as obesity and type-2 diabetes, has risen considerably in the last decades. Two meta-analyses of large cohort studies have demonstrated that a combination of at least four lifestyle factors of the following: obesity, alcohol consumption, smoking, unhealthy nutrition, and not meeting the guidelines for physical activity, was associated with 66% of mortality risk.[2,3] Therefore, promotion of healthy behaviors has become a public health imperative and preventive medicine concern.

As a professional group, physicians have a unique opportunity to promote healthy lifestyle. Most adults in western countries meet their physician at least once a year. Moreover, patients view physicians as a reliable and influential source of knowledge and advice regarding health-related behaviors.[4] Physicians with healthy habits are more likely to discuss those habits with their patients, to lead an effective dialogue and to motivate their patients to adopt a healthy lifestyle.[5,6] Frank et al demonstrated that physicians' advice was perceived as more reliable if the physician disclosed his or her own health behaviors with the patient.[7]

The Canadian, British and American Medical Associations, as well as healthcare organizations, have recently begun to recognize the potential health risks involved with the medical profession. They have created programs to address the health needs of their members, such as the British Medical Association counselling service, the Doctor Advisor Service, an online physician health and wellness resource prepared by Canadian physician health and eLearning experts, as well as biennial international conferences on physician health.[8-10]

However, physician health is not self-understood, given the unique work conditions of physicians, including long work shifts and calls, and long weekly work hours compared with the general population. In their leisure time, they often need to dedicate time to remaining up-to-date in their profession. As a result, physicians have greater struggles with work-life balance than do other workers.[11] They might, therefore, lack the time and energy required for maintaining healthy lifestyles. Physicians work in emotionally charged situations, associated with suffering, fears and death, and are exposed to considerable stress. Worldwide, they are prone to burnout, a syndrome characterized by loss of enthusiasm for work, feelings of cynicism and a low sense of personal accomplishment, despite being highly motivated at the start of their careers.[11-13]

Physician health and well-being has recently become the focus of international concern as physicians are important "citizens" of the healthcare system. Therefore, their wellness is crucial to its function. Physician ill-health negatively affects productivity, efficiency, quality of patient care and physician retention.[14]

Little is known about health and well being in the Israeli physician population. The Israeli Medical Association (IMA) is an independent professional body that represents 95% of Israeli physicians. As part of its mission, the IMA has recently initiated efforts to promote health-related behaviors among physicians, including the current study.

The objectives of this study were to examine health-related behaviors and perceptions among physicians, and to analyze the effect of personal and work characteristics on these endpoints.

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METHODS

Study design and participants

For this cross–sectional study, all IMA members were contacted by email and asked to complete an electronic questionnaire. The IMA e-mail list comprised 95% of the country's physicians. E-mails were sent in July 2015 with a short cover letter by the IMA president, containing a link to the survey. Three reminders were sent to members who did not open the mail message.

Questionnaire

The digital format dictated the design of a short questionnaire (requiring 120 seconds to complete), suitable for computers or smartphones. The questionnaire was developed in collaboration with IMA senior representatives and a panel of experts from the fields of medicine, medical ethics, health promotion, sports medicine, nutrition and biostatistics. Survey topics included physical activity (PA) (2 questions), nutrition and eating habits (7 questions), smoking (2), sleep (1), perceived health status (1), perceived emotional stress (1), contact with a regular personal physician (1), height and weight for the calculation of body mass index (BMI), as well as personal and work characteristics (8). Questions were based on validated Hebrew and international questionnaires, adapted to the digital format.[15-17] The survey tool was subjected to internal validation by the expert panel and a convenience sample of 30 respondents who were asked to provide feedback on clarity, relevance and other aspects of the tool.

Age, sex and specialty were obtained from IMA members who did not open the mail, to enable comparison of respondents with non-respondents.

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Definition of variables

Meeting PA guidelines: performing at least 150 minutes of leisure time PA in an average week.

A composite "Healthy Nutrition" measure was defined, which included: eating breakfast, eating lunch, following the principles of a Mediterranean diet [18] (consuming fruit and vegetables, whole wheat, legumes, nuts, fish, poultry and low-fat dairy products), consuming 5 units of fruits and vegetables, drinking 8 cups of water - every day or almost every day, consuming processed food or sugary drinks – never or less than once a week. Healthy nutrition was defined as complying with 6 or 7, of the 7 parameters.

Perceived health status: Physicians were asked: "In general, how would you define your health status?" (excellent, very good, good, fair or poor).

Perceived emotional stress: "To what extent do you experience emotional stress?" (very low, low, moderate, high, very high)

Statistical analysis

Chi square and t-test were employed for univariate analysis and comparisons among subgroups. Logistic regression models were estimated for perceived health and stress status as dependent variables. A binomial variable was defined for the multivariate analysis: for perceived health status: 0=poor or fair; 1=good, very good or excellent; for emotional stress: 0=very low, low or moderate; 1=high or very high.

Patient and Public Involvement

It was not appropriate or possible to involve patients or the public in this work.

RESULTS

Of 25,590 e-mail addresses that were contacted, 14,694 physicians (57.4%) opened the email, 5,374 clicked on the link to the questionnaire and 4,832 (32.9%) completed and

submitted the questionnaire. Since only half of IMA e-mails to the physicians represented by this organization are ever opened by the physicians, we calculated effective response rate as the proportion of physicians who opened the e-mail and submitted the questionnaire. . The respondents represent approximately one fifth of all physicians practicing in Israel. Sixty percent of the respondents were males, 36% were 44 years of age or younger; 15% were over age 65 years.

Three parameters were available for comparison of respondents with non-respondents: age, sex, and specialty. Age and sex distributions were similar among respondents and non-respondents. The main specialties of the respondents were internal medicine (19%), surgery and surgical sub-specialties (18%), general practice (13%) and pediatrics (12%). Among non-respondents, specialty distribution differed slightly, however with statistical significance ($p<0.0001$) (Table 1).

Table 1. Characteristics of respondents and non-respondents (%)

Variable	Non-respondents N=20,085	Respondents N=4832	P value
Age			
<35	14.5	12.5	
35-44	23.7	23.7	
45-54	21.4	21.4	0.104
55-64	21.3	26.7	
65+	17.5	14.7	
Unknown	1.7	1.1	
Gender			
Female	38.8	40.3	
Male	60.4	59.7	0.161
Medical Specialty			
Pediatrics	12.2	12.8	
General practice	13.1	13.6	
Internal Medicine	20.3	19.3	
Surgical specialties	14.7	17.9	P<0.0001

Anesthesiology	4.4	0.4
Obstetrics and Gynecology	7.1	8.0

Nineteen percent of the respondents were residents or fellows, 71% were seniors, and 8% were not in either of these categories, i.e. did not hold a medical specialty yet were not currently in residency (Table 2). Physicians were asked to state their main work setting – hospital, community or similar work volume in both hospital and community. Fifty-one percent worked in hospitals, 31% in the community and 6% - in both settings. The remainder worked in Ministry of Health facilities and other settings. These data are comparable with national figures that indicate that the main work settings of physicians are the hospital (54%) and the community (39%).[19]

Respondents, whose major work setting was the hospital, were younger, more likely male, and more likely in residency, compared with those working in the community; yet senior physicians were the majority (63%) of hospital respondents (Table 2).

Table 2. Demographic characteristics of respondents by work setting (%): **N=4832**

Main work setting	Hospital	Community	Combined*	Total	P Value
Age (years)					
<35	21.5	3.6	4.3	12.5	<0.0001
35-44	30.4	18.7	26.0	23.7	
45-54	19.3	26.3	31.7	21.4	
55-64	21.7	35.1	28.5	26.7	
+65	7.0	16.4	9.6	14.7	
Gender					
Female	36.5	49.1	36.5	40.3	<0.0001
Male	63.5	50.9	63.5	59.7	
Level of training					
Resident/fellow	33.3	5.4	5.3	19.2	<0.0001
Senior	62.9	81.9	86.9	71.3	

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| Other | 3.8 | 12.7 | 7.8 | 8.2 |

*similar work volume in both hospital and community

Twenty-one percent reported poor or fair health status, with no significant difference by work place. Thirty-six percent reported a high or very high level of emotional stress. More females reported high stress than males (40.5 and 33.2% respectively, p<0.0001). Residents were the sub-group with the highest stress levels: 49.8% reported high or very high stress, compared with 33.5% of seniors (p<0.0001). The hospital setting was associated with a higher perceived level of considerable stress than the community setting: 43.4% and 30.6%, respectively (p<0.0001) (Table 3). BMI was in the normal range for 41.7% of respondents, with 41.4% and 15.9% overweight and obese, respectively. Overweight and obesity (BMI$\geq$25kg/m^2) were more prevalent among male than female respondents: 67.2% and 42.2%, respectively (p<0.0001) and among those working in the community than the hospital (Table 3).

Table 3. Health status by work setting (%): **N=4832**

Variable	Hospital	Community	Combined	Total	P Value
Perceived Health Status					
Excellent	12.0	11.0	11.4	11.1	0.074
Very good	36.0	31.3	35.7	33.5	
Good	32.5	35.9	31.8	33.6	
Fair	17.4	19.9	18.9	18.9	
Poor	2.2	1.9	2.1	2.2	
Perceived level of emotional stress					
Very low	4.8	9.5	7.4	7.6	<0.0001
Low	17.0	20.0	24.5	19.5	
Moderate	34.7	39.9	34.0	36.3	
High	32.8	23.3	24.5	27.1	
Very high	10.6	7.3	9.6	8.8	
Body mass index (BMI)*					
Underweight (<18.5 kg/m^2)	1.4	0.5	1.6	1.0	<0.0001
Normal weight (>18.5 to ≤25 kg/m^2)	45.5	37.7	35.9	41.7	
Overweight (>25 to ≤30 kg/m^2)	38.9	43.6	48.4	41.4	
Obese (>30kg/m^2)	14.2	18.1	14.1	15.9	

N=4,349; 8.8% of respondents did not report weight and/or height data

Twenty-eight percent reported not exercising at all, while 29% met the recommended PA target (≥150 minutes weekly). A higher proportion of male than female respondents met the PA target (32.5 and 27.2%, respectively; p<0.0001). Only 15.0% of residents, compared with 34.1% of seniors, met the target. Community physicians were significantly more active (Table 4). Twenty-one percent complied with the "healthy nutrition measure" (6 or 7 of 7 healthy nutrition parameters). Compliance with separate nutritional items is detailed in Table 4. Overall, females had healthier nutritional habits

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than males. Most eating habits were healthier among community than hospital physicians (Table 4). Among residents, hospital, community, and overall respondents, 16%, 10%, 7% and 8.5% were current smokers, respectively. Twenty-five percent reported sleeping 5 hours or less on an average night, while only 23% slept 7 or more hours, as recommended. Only 16% of hospital physicians slept 7 or more hours nightly. Forty-three percent of respondents (38 and 46% in the hospital and community, respectively) had a personal physician on a regular basis.

Table 4. Health-related behavior by work setting (%): **N=4832**

Variable	Hospital	Community	Combined	Total	P Value
Physical activity in a typical week					
Not exercising	33.8	22.6	29.4	28.0	<0.0001
1-3 times/week	50.9	55.2	56.4	52.3	
4-7 times/week	15.3	22.2	14.2	19.0	
<150 min/week	74.8	65.1	73.1	66.3	<0.0001
≥150 min/week	25.2	34.9	26.9	28.9	
Nutrition & eating habits (every day or almost every day)					
Breakfast	46.6	59.0	45.0	52.7	<0.0001
Lunch	47.2	48.6	38.4	48.5	<0.0001
Mediterranean Diet	30.8	37.1	29.4	33.8	<0.0001
Drinking 8 cups of water	31.1	43.1	32.2	35.9	<0.0001
Processed food	22.4	11.3	19.2	17.5	<0.0001
Sweetened beverages	13.0	8.5	12.5	11.0	<0.0001
5 units of fruits & vegetables	29.0	37.6	28.1	33.1	<0.0001
Cigarette smoking					
Currently	10.1	6.8	9.3	8.5	0.002
Average hours of sleep at night					
≤5 Hours	32.5	17.7	25.3	24.8	<0.0001
6 Hours	51.4	54.5	53.8	50.6	
7 Hours	16.1	27.8	20.9	20.9	
≥8 Hours	1.4	3.2	1.4	2.4	
Has a regular physician for his/her personal health	38.0	46.1	35.6	43.0	<0.0001

The multivariate analysis revealed that younger age, senior status, good nutrition score, meeting the PA target and lower emotional stress were all variables that explained the perception of good health status. Female sex, younger age, poor nutritional habits, not achieving the recommended PA target and inadequate sleep were all variables that explained high stress levels (Table 5).

Table 5. Results of the Logistic Regression Models for health and stress perceptions as dependent variables

Variable*	B	S.E	P Value	OR	95% CI
Perceived Health Status					
Gender	-0.04	0.09	0.683	0.97	0.79-1.15
Age	-0.36	0.04	<0.0001	0.69	0.63-0.76
Residency	-0.49	0.14	0.001	0.61	0.46-0.80
Stress	-0.46	0.04	<.0001	0.63	0.67-0.58
Nutrition	0.41	0.12	0.001	1.50	1.18-1.91
PA	0.79	0.11	<0.0001	2.24	1.78-2.77
Smoking	-0.07	0.14	0.601	0.92	0.70-1.23
BMI	-0.13	0.01	<0.0001	0.87	0.85-0.89
Perceived level of emotional stress					
Gender	-0.29	0.07	<0.001	0.74	0.64-0.85
Age	-0.36	0.03	<0.001	0.69	0.64-0.74
Residency	-0.096	0.10	0.354	0.90	0.74-1.13
Nutrition	-0.37	0.09	<0.001	0.66	0.55-0.78
PA.	-0.19	0.07	<0.001	0.68	0.57-0.82
Sleep	-0.60	0.09	<0.001	0.54	0.45-0.65
Health Status	-0.73	0.08	<0.001	0.48	0.40-0.56

S.E=Standard Error; OR=Odds Ratio; 95% CI=95% Confidence Interval

Gender: male=1, female = 0; Residency: resident = 1 attending = 0; Nutrition: 6-7 items of good nutrition, daily or almost daily= 1; others =0; Physical Activity: meets PA guidelines =1, others =0; Health Status: excellent, very good and good = 1; fair or poor = 0; Emotional stress: Very low, low or, moderate =0; high or very high =1.

DISCUSSION

The results from a national health survey show that health-related behaviors of Israeli physicians are far from optimal. Compared with the Israeli population of similar socioeconomic background,[17,20,21] fewer respondents achieve the recommended PA target, more are overweight, but fewer smoke. Compared with Canadian and US

physicians, populations for which these issues have been studied in the last decade, fewer Israeli physicians met PA guidelines, more were overweight or obese and more were current smokers.[16,22,23] Compared with their Canadian colleagues, Israeli physicians tended more frequently to perceive their health as fair or poor, by 2.3 times.[16] Large and comprehensive studies on health promoting behaviors to prevent chronic illness among physicians are few, and use different designs. Canadian and some U.S. studies demonstrated better practices among physicians than comparable general populations.[23,24] However, these findings are not universal: junior British doctors met PA targets less often than the general population;[25] Bahrain primary care physicians were less likely to meet PA targets or to have BMI at the normal range than the general population.[26] In California, more physicians were not exercising at all or exercising only occasionally, and fewer tended to eat breakfast regularly, compared with the adult US population.[27] Seventy-one percent of Australian junior doctors were concerned about their own health.[28]

Worldwide, physicians are known as "bad" patients who do not have a regular physician for their personal health. Our finding that two-thirds of hospital-based physicians do not have a regular personal physician supports a previous study that demonstrated that 82% of hospital physicians had been asked by their colleagues to provide "hallway medicine", and 91% of them agreed.[29]

High levels of emotional stress have been repeatedly described among physicians. For example, 49% of Canadian women physicians reported usually having high levels of stress;[30] and 70% of Australian junior physicians reported experiencing high levels of stress at work [28]. When left untreated, chronic stress may lead to burnout.[12]

Why do physicians, who enjoy high health literacy, make sub-optimal use of their knowledge and skills to adopt healthy lifestyles? A possible explanation for unhealthy

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lifestyles among Israeli physicians is the unique reimbursement mechanisms in the

healthcare system, which dictates a "multi-employer" reality, especially for hospital

senior physicians, who frequently work in the evenings for a health plan or in their

private clinic.[31] They may therefore lack the time and energy to invest in healthy

lifestyles. Unsurprisingly, excessive work hours have been shown to be associated with

lack of exercise, not eating breakfast, less sleeping hours and higher BMI.[23,27]

We recently administered the same questionnaire used in the current study to 151

second-year medical students (of 170 students, response rate 88%, mean age 24.7,

SD=2.7). The students demonstrated considerably better behaviors than did residents

(unpublished data). Understanding the nature of the "slippery slope" is of great

importance in regard to health-related behaviors along the clinical years of medical

school and during residency.

Associations shown between achieving PA target and reducing burnout[32] should

encourage health organizations as well as individuals to promote and improve lifestyle

areas such as PA, nutrition and sleep, for the benefit of health and health perception,

and to reduce stress and burnout. Furthermore, improved personal health behaviors of

physicians might affect their patients, and thus society at large.[5,6]

Following the findings of this study, the IMA has accelerated a number of diverse

programs to promote health-related behaviors to prevent chronic illness among its

members, such as designating smoking cessation workshops for physicians, guided

exercise sessions and personal trainer service for physicians and their spouses, stress

and resilience workshops, and a position paper urging the serving of healthy food at

staff meetings and conventions. The main findings of the current survey, as well as a

list of resources to promote healthy behaviors, have been distributed to all members of

the IMA.[33] Physicians were encouraged to ask their organizational managements to improve nutritional options at cafeterias and coffee shops at medical facilities.

This study has a number of limitations. A digital survey dictated a relatively short questionnaire. Therefore, important topics such as physician burnout and complying with immunization and health screening were not included. Although the 33% response rate achieved was declared as the highest response rate ever achieved by the IMA in mail surveys among its members, it can be viewed as a barrier to generalizing the findings to a larger physician population. In general, physicians are known as a professional group with low survey response rates, for example, survey response among Canadian physicians was 34.1% and 29.9%, if contacted by regular mail or e-mail, respectively.[34] A meta-analysis that compared the response rates of e-mail versus mail surveys found that e-mail surveys generally have lower response rate (about 20% lower on the average) than mail surveys.[35]

The respondents of the current survey were similar to the non-respondents in distributions of sex, age and specialty. We expect that physicians who felt more positive about their health behaviors would be more likely to respond to the survey. If this was in fact the case, then the actual health status of the physicians would be worse than that described.

CONCLUSIONS

Our findings raise concern about health behaviors of Israeli physicians and point to the urgent need for preventive and health promotion initiatives. Interventions focusing on two stages of the physician's life may be meaningful: medical training, in which students should be provided with healthy lifestyle knowledge and practical tools to help them implement it; and professional work, with a focus on hospitals. Physicians should be provided with healthier food and beverage options at medical facilities,

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especially during long work hours, and encouraged to partake in physical activity and

stress reduction options. Such interventions could benefit physicians, patients, the

community and the healthcare system at large.

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1 **Health-related behaviors and perceptions among physicians: Results from a**

2 **cross-sectional study**

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16 **Contributors:** RWM led all the stages of the research, from conception, through

17 design, interpretation of the data and drafting of all article components. LM made

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19 critically revised the article manuscripts. LR made a substantial contribution to

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47 **Abstract**

48 **Objectives:** Physicians' demanding work conditions may reduce the time and energy

49 required for maintaining healthy lifestyles. This study examined health-related

50 behaviors, perceived health status and emotional stress among physicians, and analyzed

51 the effects of personal and work characteristics on these endpoints.

52   **Design:** A cross-sectional study using a digital questionnaire.

53 **Setting and participants:** All 25,590 physicians who were members of the Israeli

54 Medical Association in 2015 were invited to participate by email. Of 14,694 who

55 opened the e-mail, 4,832 (32.9%) responded.

56 **Outcome measures:** Survey topics included physical activity (PA), nutrition and

57 eating habits, smoking, sleep, perceived health status and emotional stress, body mass

58 index (BMI) and contact with a regular physician, as well as personal and work

59 characteristics. Uni- and multivariate analyses were performed.

60 **Results**:

61 Of the 4,832 respondents, 21% reported poor or fair health status, 36% felt considerable

62 emotional stress, 57% were overweight or obese (according to BMI $\geq$25 kg/m^2), 71%

63 did not meet the recommended PA level, 79%% did not meet a composite measure of

64 healthy nutrition, 8% were current smokers, 25% slept 5 hours or less, and 57% did not

65 have a regular physician. Residents and hospital physicians reported significantly less

66 healthy lifestyles, lower perceived health status, and higher stress levels, compared with

67 senior and community physicians. Multivariate analysis demonstrated that being female

68 (OR=0.74, CI=0.64-0.85), younger (0.69, 0.64-0.74), having poor nutrition (0.66, 0.55-

69 0.78), not meeting PA targets (0.68, 0.57-0.82), inadequate sleep (0.54, 0.40-0.56), and

70 perceived poor health status (0.48, 0.40-0.56) were significantly associated with high

71 stress levels (p<0.001).

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72 **Conclusions:** The unfavorable health behaviors reported among Israeli physicians may

73 have negative effects on their health and well-being. An intervention program to help

74 physicians adopt healthier lifestyle is urgently needed.

75 **Keywords:** physicians, healthy lifestyle; health promoting behaviors; stress; health

76 perception.

6

Strengths and limitations of this study

- This national study portrayed the health behaviors of a relatively large number of respondents (n=4,832), the largest of its kind in Israel.

-

- The study questionnaire covered a large number of health behaviors and perceptions, allowing to portray a relatively comprehensive picture of Israeli physicians' wellness.

- The physicians were not asked if they undergo regular screening tests as recommended.

- A response rate of 33% is a barrier to generalizing the findings to a larger physician population.

- Physicians who felt more positive about their health behaviors were more likely to respond to the survey; therefore the actual health status of the physicians would be worse than that described.

INTRODUCTION

Non-communicable diseases, comprising mainly cardiovascular diseases, diabetes, cancer and chronic respiratory diseases, are the leading causes of death globally, accounting for 68% of deaths in 2012.[1] The prevalence of lifestyle-related diseases, such as obesity and type-2 diabetes, has risen considerably in the last decades. Two meta-analyses of large cohort studies have demonstrated that a combination of at least four lifestyle factors of the following: obesity, alcohol consumption, smoking, unhealthy nutrition, and not meeting the guidelines for physical activity (PA), was associated with 66% of mortality risk.[2,3] Therefore, promotion of healthy behaviors has become a public health imperative and preventive medicine concern.

As a professional group, physicians have a unique opportunity to promote healthy lifestyle. Most adults in western countries meet their physician at least once a year. Moreover, patients view physicians as a reliable and influential source of knowledge and advice regarding health-related behaviors.[4] Physicians with healthy habits are more likely to discuss those habits with their patients, to lead an effective dialogue and to motivate their patients to adopt a healthy lifestyle.[5,6] Frank et al demonstrated that physicians' advice was perceived as more reliable if the physician disclosed his or her own health behaviors with the patient.[7]

However, physician health is not self-understood, given the unique work conditions of physicians, including long work shifts and calls, and long weekly work hours compared with the general population. In their leisure time, they often need to dedicate time to remaining up-to-date in their profession. As a result, physicians have greater struggles with work-life balance than do other workers.[8] They might, therefore, lack the time and energy required for maintaining healthy lifestyles. Physicians work in emotionally charged situations, associated with suffering, fears

8

116   and death, and are exposed to considerable stress. Concerns about physicians' mental

117   health were documented as early as 1883 when Mattison described opium addicts

118   among physicians[9]. In 1973 the American Medical Association published a report that

119   related to psychiatric disorders that might impair physician functioning.[10] Burnout

120   was mentioned as an entity for the first time in 1975 to describe "failure or exhaustion

121   because of excessive demands on energy, strength, or resources" among the staff of

122   alternative self-help clinics in the United States.[11] Burnout among physicians may

123   lead to loss of enthusiasm for work, feelings of cynicism and a low sense of personal

124   accomplishment, despite being highly motivated at the start of their careers.[8,12,13]

125   Physician health and well-being has recently become the focus of international concern

126   as physicians are important "citizens" of the healthcare system. Therefore, their

127   wellness is crucial to its function. Physician ill-health negatively affects productivity,

128   efficiency, quality of patient care and physician retention.[14]

129   The Canadian, British and American Medical Associations, as well as healthcare

130   organizations, have recently begun to recognize the potential health risks involved with

131   the medical profession. They have created programs to address the health needs of their

132   members, such as the British Medical Association counselling service, the Doctor

133   Advisor Service, an online physician health and wellness resource prepared by

134   Canadian physician health and eLearning experts, as well as biennial international

135   conferences on physician health.[15-17]

136   Israel is characterized by a low hospital bed-to-population ratio and a high occupancy

137   rate compared with other Organization for Economic Co-operation and Development

138   (OECD) countries and the European Union (EU) average. The physician-to-population

139   ratio is somewhat lower than that of EU countries, with downward trending.[18] The

140   Israeli healthcare system is characterized by a unique reimbursement mechanism,

141 which dictates a "multi-employer" reality, especially for senior hospital physicians,

142 who frequently work full-time as salaried employees in the public system and continue

143 their working day in the evenings as self-employed physicians for a health fund (health

144 maintenance organization) or in their private clinic.[19] The above mentioned

145 combination of deficient infrastructures and unique reimbursement methods creates

146 considerable workloads and possibly also a greater work-life imbalance.

147 Little is known about health and wellbeing in the Israeli physician population. The

148 Israeli Medical Association (IMA) is an independent professional body that represents

149 95% of Israeli physicians. As part of its mission, the IMA has recently initiated efforts

150 to promote health-related behaviors among physicians, including the current study.

151 The objectives of this study were to examine health-related behaviors and perceptions

152 among physicians, and to analyze the effect of personal and work characteristics on

153 these endpoints.

METHODS

Study design and participants

For this cross–sectional study, all IMA members were contacted by email and asked to complete an electronic questionnaire (Online supplementary file 1). The IMA e-mail list comprised 95% of the country's physicians. E-mails were sent in July 2015 with a short cover letter by the IMA president, containing a link to the survey. Three reminders were sent, between July and August 2015, to members who did not open the mail message.

Questionnaire

The digital format dictated the design of a short questionnaire (requiring 120 seconds to complete), suitable for computers or smartphones. The questionnaire was developed in collaboration with IMA senior representatives and a panel of experts from the fields of medicine, medical ethics, health promotion, sports medicine, nutrition and biostatistics. Survey topics included PA (2 questions), nutrition and eating habits (7 questions), smoking (2), sleep (1), perceived health status (1), perceived emotional stress (1), contact with a regular personal physician (1), height and weight for the calculation of body mass index (BMI), as well as personal and work characteristics (8). Questions were based on validated Hebrew and international questionnaires, adapted to the digital format.[20-22] The survey tool was subjected to internal validation by the expert panel and a convenience sample of 30 respondents who were asked to provide feedback on clarity, relevance and other aspects of the tool.

Age, sex and specialty were obtained from IMA members who did not open the mail, to enable comparison of respondents with non-respondents.

Definition of variables

177 **Definition of variables**

178 Meeting PA guidelines: performing at least 150 minutes of leisure time PA in an

179 average week.

180 A composite "Healthy Nutrition" measure was defined, which included: eating

181 breakfast, eating lunch, following the principles of a Mediterranean diet[23] (consuming

182 fruit and vegetables, whole wheat, legumes, nuts, fish, poultry and low-fat dairy

183 products), consuming 5 units of fruits and vegetables, drinking 8 cups of water - every

184 day or almost every day, consuming processed food or sugary drinks – never or less

185 than once a week. Healthy nutrition was defined as complying with 6 or 7, of the 7

186 parameters.

187 Perceived health status: Physicians were asked: "In general, how would you define your

188 health status?" (excellent, very good, good, fair or poor).

189 Perceived emotional stress: "To what extent do you experience emotional stress?" (very

190 low, low, moderate, high, very high)

Statistical analysis

191 **Statistical analysis**

192 Chi square and t-test were employed for univariate analysis and comparisons among

193 subgroups. Logistic regression models were estimated for perceived health and stress

194 status as dependent variables. A binomial variable was defined for the multivariate

195 analysis: for perceived health status: 0=poor or fair; 1=good, very good or excellent;

196 for emotional stress: 0=very low, low or moderate; 1=high or very high.

Patient and Public Involvement

197 **Patient and Public Involvement**

198 It was not appropriate or possible to involve patients or the public in this work as it was

199 not relevant to the research question.

12

200 **RESULTS**

201 Of 25,590 e-mail addresses that were contacted, 14,694 physicians (57.4%) opened the

202 email, 5,374 clicked on the link to the questionnaire and 4,832 (32.9%) completed and

203 submitted the questionnaire. Since only half of IMA e-mails to the physicians

204 represented by this organization are ever opened by the physicians, we calculated

205 effective response rate as the proportion of physicians who opened the e-mail and

206 submitted the questionnaire. . The respondents represent approximately one fifth of all

207 physicians practicing in Israel. Sixty percent of the respondents were males, 36% were

208 44 years of age or younger; 15% were over age 65 years.

209 Three parameters were available for comparison of respondents with non-respondents:

210 age, sex, and specialty. Age and sex distributions were similar among respondents and

211 non-respondents. The main specialties of the respondents were internal medicine

212 (19%), surgery and surgical sub-specialties (18%), general practice (13%) and

213 pediatrics (12%). Among non-respondents, specialty distribution differed slightly,

214 however with statistical significance (p<0.0001) (Table 1).

215 **Table 1. Characteristics of respondents and non-respondents (%)**

Variable	Non-respondents N=20,085	Respondents N=4832	P value
Age			
<35	14.5	12.5	
35-44	23.7	23.7	
45-54	21.4	21.4	0.104
55-64	21.3	26.7	
65+	17.5	14.7	
Unknown	1.7	1.1	
Gender			
Female	38.8	40.3	0.161
Male	60.4	59.7	
Medical Specialty			
Pediatrics	12.2	12.8	
General practice	13.1	13.6	
Internal Medicine	20.3	19.3	
Surgical specialties	14.7	17.9	P<0.0001
Anesthesiology	4.4	0.4	
Obstetrics and Gynecology	7.1	8.0	

216 Nineteen percent of the respondents were residents or fellows, 71% were seniors, and

217 8% were not in either of these categories, i.e. did not hold a medical specialty yet were

218 not currently in residency (Table 2). Physicians were asked to state their main work

219 setting – hospital, community or similar work volume in both hospital and community.

220 Fifty-one percent worked in hospitals, 31% in the community and 6% - in both settings.

221 The remainder worked in Ministry of Health facilities and other settings. These data are

222 comparable with national figures that indicate that the main work settings of physicians

223 are the hospital (54%) and the community (39%).[24]

224 Respondents, whose major work setting was the hospital, were younger, more likely

225 male, and more likely in residency, compared with those working in the community;

226 yet senior physicians were the majority (63%) of hospital respondents (Table 2).

14

227 **Table 2. Demographic characteristics of respondents by work setting (%)**

Main work setting	Hospital N=2,472	Community N=1,482	Combined[a] N=282	Total N=4,832[b]	P Value
Age (years)[c]					
<35	21.5	3.6	4.3	12.5	<0.0001
35-44	30.4	18.7	26.0	23.7	
45-54	19.3	26.3	31.7	21.4	
55-64	21.7	35.1	28.5	26.7	
+65	7.0	16.4	9.6	14.7	
Gender					
Female	36.5	49.1	36.5	40.3	<0.0001
Male	63.5	50.9	63.5	59.7	
Level of training[d]					
Resident/fellow	33.3	5.4	5.3	19.2	<0.0001
Senior	62.9	81.9	86.9	71.3	
Other	3.8	12.7	7.8	8.2	

228 [a] Similar work volume in both hospital and community

229 [b]The "total" column contains data on 596 (12%) of respondents who did not define their

230 main work setting by one of the three major categories (i.e. worked for the Ministry of

231 Health, worked only in a private clinic or in an "unspecified" work setting

232 [c]Age data was missing for 52 (1.1%) of respondents.[d]Data on level of training was

233 missing for 65 (1.3%) of respondents.

234   Twenty-one percent reported poor or fair health status, with no significant difference

235   by work place. Thirty-six percent reported a high or very high level of emotional stress.

236   More females reported high stress than males (40.5 and 33.2% respectively, p<0.0001).

237   Residents were the sub-group with the highest stress levels: 49.8% reported high or

238   very high stress, compared with 33.5% of seniors (p<0.0001). The hospital setting was

239   associated with a higher perceived level of considerable stress than the community

240   setting: 43.4% and 30.6%, respectively (p<0.0001) (Table 3). BMI was in the normal

241   range for 41.7% of respondents, with 41.4% and 15.9% overweight and obese,

242   respectively. Overweight and obesity (BMI$\geq$25kg/m^2) were more prevalent among

243   male than female respondents: 67.2% and 42.2%, respectively (p<0.0001) and among

244   those working in the community than the hospital (Table 3).

16

245 **Table 3. Health status by work setting (%)**

Variable	Hospital N=2,472	Community N=1,482	Combined N=282	Total N=4,832	P Value
Perceived health status[a]					
Excellent	12.0	11.0	11.4	11.1	0.074
Very good	36.0	31.3	35.7	33.5	
Good	32.5	35.9	31.8	33.6	
Fair	17.4	19.9	18.9	18.9	
Poor	2.2	1.9	2.1	2.2	
Perceived level of emotional stress[b]					
Very low	4.8	9.5	7.4	7.6	<0.0001
Low	17.0	20.0	24.5	19.5	
Moderate	34.7	39.9	34.0	36.3	
High	32.8	23.3	24.5	27.1	
Very high	10.6	7.3	9.6	8.8	
Body mass index (BMI)[c]					
Underweight (<18.5 kg/m^2)	1.4	0.5	1.6	1.0	<0.0001
Normal weight (>18.5 to ≤25 kg/m^2)	45.5	37.7	35.9	41.7	
Overweight (>25 to ≤30 kg/m^2)	38.9	43.6	48.4	41.4	
Obese (>30kg/m^2)	14.2	18.1	14.1	15.9	

246 [a]N=4,796; 36 (0.7%) of respondents did not report perceived health status

247 [b]N=4798; 34 (0.7%) of respondents did not report perceived emotional stress

248 [c]N=4,349; 483 (9.0%) of respondents did not report weight and/or height data

249   Twenty-eight percent reported not exercising at all, while 29% met the recommended

250   PA target (≥150 minutes weekly). A higher proportion of male than female respondents

251   met the PA target (32.5 and 27.2%, respectively; p<0.0001). Only 15.0% of residents,

252   compared with 34.1% of seniors, met the target. Community physicians were

253   significantly more active (Table 4). Twenty-one percent complied with the "healthy

254   nutrition measure" (6 or 7 of 7 healthy nutrition parameters). Compliance with separate

255   nutritional items is detailed in Table 4. Overall, females had healthier nutritional habits

256   than males. Most eating habits were healthier among community than hospital

257   physicians (Table 4). Among residents, hospital, community, and overall respondents,

258   16%, 10%, 7% and 8.5% were current smokers, respectively. Twenty-five percent

259   reported sleeping 5 hours or less on an average night, while only 23% slept 7 or more

260   hours, as recommended. Only 16% of hospital physicians slept 7 or more hours nightly.

261   Forty-three percent of respondents (38 and 46% in the hospital and community,

262   respectively) had a personal physician on a regular basis.

263 **Table 4. Health-related behavior by work setting (%)**

Variable	Hospital N=2,472	Community N=1,482	Combined N=282	Total N=4,832	P Value
Physical activity in a typical week[a]					
Not exercising	33.8	22.6	29.4	28.0	<0.0001
1-3 times/week	50.9	55.2	56.4	52.3	
4-7 times/week	15.3	22.2	14.2	19.0	
<150 min/week	74.8	65.1	73.1	66.3	<0.0001
≥150 min/week	25.2	34.9	26.9	28.9	
Nutrition & eating habits (every day or almost every day)					
Breakfast	46.6	59.0	45.0	52.7	<0.0001
Lunch	47.2	48.6	38.4	48.5	<0.0001
Mediterranean Diet	30.8	37.1	29.4	33.8	<0.0001
Drinking 8 cups of water	31.1	43.1	32.2	35.9	<0.0001
Processed food	22.4	11.3	19.2	17.5	<0.0001
Sweetened beverages	13.0	8.5	12.5	11.0	<0.0001
5 units of fruits & vegetables	29.0	37.6	28.1	33.1	<0.0001
Cigarette smoking					
Currently	10.1	6.8	9.3	8.5	0.002
Average hours of sleep at night[b]					
≤5 Hours	32.5	17.7	25.3	24.8	<0.0001
6 Hours	51.4	54.5	53.8	50.6	
7 Hours	16.1	27.8	20.9	20.9	
≥8 Hours	1.4	3.2	1.4	2.4	
Has a regular physician for his/her personal health	38.0	46.1	35.6	43.0	<0.0001

264 [a]N=4,600; 232 (4.8%) of respondents did not provide complete information on physical
265 activity
266 [b]N=4,769; 63 (1.3%) of respondents did not report sleeping hours

267 The multivariate analysis revealed that the variables younger age, senior status, good

268 nutrition score, meeting the PA target and lower emotional stress were all t associated

269 with the perception of good health status. The variables female sex, younger age, poor

270 nutritional habits, not achieving the recommended PA target and inadequate sleep were

271 all associated with high stress levels (Table 5).

272 **Table 5. Results of the logistic regression models for health and stress perceptions**

273 **as dependent variables**

Variable*	B	SE	P Value	OR	95% CI
Perceived health status					
Gender	-0.04	0.09	0.683	0.97	0.79-1.15
Age	-0.36	0.04	<0.0001	0.69	0.63-0.76
Residency	-0.49	0.14	0.001	0.61	0.46-0.80
Stress	-0.46	0.04	<.0001	0.63	0.67-0.58
Nutrition	0.41	0.12	0.001	1.50	1.18-1.91
PA	0.79	0.11	<0.0001	2.24	1.78-2.77
Smoking	-0.07	0.14	0.601	0.92	0.70-1.23
BMI	-0.13	0.01	<0.0001	0.87	0.85-0.89
Perceived level of emotional stress					
Gender	-0.29	0.07	<0.001	0.74	0.64-0.85
Age	-0.36	0.03	<0.001	0.69	0.64-0.74
Residency	-0.096	0.10	0.354	0.90	0.74-1.13
Nutrition	-0.37	0.09	<0.001	0.66	0.55-0.78
PA.	-0.19	0.07	<0.001	0.68	0.57-0.82
Sleep	-0.60	0.09	<0.001	0.54	0.45-0.65
Health status	-0.73	0.08	<0.001	0.48	0.40-0.56

274 BMI=body mass index; CI=confidence interval; OR=odds ratio; PA=physical activity;

275 SEstandard error; OR=odds ratio

276 Gender: male=1, female = 0; Residency: resident = 1 attending = 0; Nutrition: 6-7

277 items of good nutrition, daily or almost daily= 1; others =0; PA: meets PA guidelines

278 =1, others =0; Health status: excellent, very good and good = 1; fair or poor = 0;

279 Emotional stress: very low, low or, moderate =0; high or very high =1.

280 **DISCUSSION**

281 The results from a national health survey show that health-related behaviors of Israeli

282 physicians are far from optimal. Compared with the Israeli population of similar

283 socioeconomic background,[22,25,26] fewer respondents achieve the recommended PA

284 target, more are overweight, but fewer smoke. Compared with Canadian and US

285 physicians, populations for which these issues have been studied in the last decade,

286 fewer Israeli physicians met PA guidelines, more were overweight or obese and more

287 were current smokers.[21,27,28] Compared with their Canadian colleagues, Israeli

288 physicians tended more frequently to perceive their health as fair or poor, by 2.3 times.[21]

289 Large and comprehensive studies on health promoting behaviors to prevent chronic

290 illness among physicians are few, and use different designs. Canadian and some US

291 studies demonstrated better practices among physicians than comparable general

292 populations.[28,29] However, these findings are not universal: junior British doctors met

293 PA targets less often than the general population;[30] Bahrain primary care physicians

294 were less likely to meet PA targets or to have BMI at the normal range than the general

295 population.[31] In California, more physicians were not exercising at all or exercising only

296 occasionally, and fewer tended to eat breakfast regularly, compared with the adult US

297 population.[32] Seventy-one percent of Australian junior doctors were concerned about

298 their own health.[33]

299 Worldwide, physicians are known as "bad" patients who do not have a regular

300 physician for their personal health. Our finding that two-thirds of hospital-based

301 physicians do not have a regular personal physician supports a previous study that

302 demonstrated that 82% of hospital physicians had been asked by their colleagues to

303 provide "hallway medicine", and 91% of them agreed.[34]

304 High levels of emotional stress have been repeatedly described among physicians. For

305 example, 49% of Canadian female physicians reported usually having high levels of

306   stress;[35] and 70% of Australian junior physicians reported experiencing high levels of

307   stress at work [33]. When left untreated, chronic stress may lead to burnout.[12] West and

308   colleagues listed diverse work-related drivers, such as excessive workload, work

309   inefficiency (i.e. clerical burdens) and loss of control and autonomy as contributors to

310   physician burnout.[36] Hospital-based Chinese physicians with a shift-based schedule and

311   a heavy workload were more susceptible to burnout. Imbalance between high job

312   demand and low self-control indicated a high level of occupational stress exposure.[37]

313   The current study demonstrated higher perceived emotional stress among hospital

314   physicians compared with community-based physicians. In Israel, 61% of the

315   physicians are salaried, 33% are both salaried and self-employed while 6% are

316   exclusively self-employed.[24] Less sense of control over work demands among salaried

317   physicians in the hospital setting, compared with self-employed physicians in the

318   community setting might be related to higher stress. Why do physicians, who enjoy

319   high health literacy, make sub-optimal use of their knowledge and skills to adopt

320   healthy lifestyles? As mentioned above, the reimbursement mechanisms of the Israeli

321   healthcare system   contribute to long work hours.[19] Physicians may therefore lack the

322   time and energy to invest in healthy lifestyles. Unsurprisingly, excessive work hours

323   were associated with lack of exercise, not eating breakfast, less sleeping hours and

324   higher BMI.[28,32]

325   We recently administered the same questionnaire used in the current study to 151

326   second-year medical students (a response rate of 88% from 170 students, mean age

327   24.7, standard deviation 2.7). The students demonstrated considerably better health

328   behaviors than did residents (Wilf Miron R, Comparison between health-related

329   behaviors of medical students and residents). Understanding the nature of the "slippery

22

330 slope" is of great importance in regard to health-related behaviors along the clinical

331 years of medical school and during residency.

332 Associations shown between achieving PA target and reducing burnout[38] should

333 encourage health organizations as well as individuals to promote and improve lifestyle

334 areas such as PA, nutrition and sleep, for the benefit of health and health perception,

335 and to reduce stress and burnout. Furthermore, improved personal health behaviors of

336 physicians might affect their patients, and thus society at large.[5,6]

337 Following the findings of this study, the IMA has accelerated a number of diverse

338 programs to promote health-related behaviors to prevent chronic illness among its

339 members, such as designating smoking cessation workshops for physicians, guided

340 exercise sessions and personal trainer service for physicians and their spouses, stress

341 and resilience workshops, and a position paper urging the serving of healthy food at

342 staff meetings and conventions. The main findings of the current survey, as well as a

343 list of resources to promote healthy behaviors, have been distributed to all members of

344 the IMA.[39] Physicians were encouraged to ask their organizational managements to

345 improve nutritional options at cafeterias and coffee shops at medical facilities.

346 This study has a number of limitations. A digital survey dictated a relatively short

347 questionnaire. Therefore, important topics such as physician burnout and complying

348 with immunization and health screening were not included. Although the 33% response

349 rate achieved was declared as the highest response rate ever achieved by the IMA in

350 mail surveys among its members, it can be viewed as a barrier to generalizing the

351 findings to a larger physician population. In general, physicians are known as a

352 professional group with low survey response rates, for example, survey response among

353 Canadian physicians was 34.1% and 29.9%, if contacted by regular mail or e-mail,

354 respectively.[40] A meta-analysis that compared the response rates of e-mail versus mail

surveys found that e-mail surveys generally have lower response rate (about 20% lower

on the average) than mail surveys.[41]

The respondents of the current survey had similar distributions of sex and age in

comparison to non-respondents, but the distribution of specialties was different

between these groups. We expect that physicians who felt more positive about their

health behaviors would be more likely to respond to the survey. If this was in fact the

case, then the actual health status of the physicians would be worse than that described.

It should be noted that the current study did not measure some important work-related

factors, such as shift work or perceived control over work demands that might be

relevant for a policy response.

CONCLUSIONS

Our findings raise concern about health behaviors of Israeli physicians and point to

the urgent need for preventive and health promotion initiatives. Interventions focusing

on two stages of the physician's life may be meaningful: medical training, in which

students should be provided with healthy lifestyle knowledge and practical tools to

help them implement it; and professional work, with a focus on hospitals. Physicians

should be provided with healthier food and beverage options at medical facilities,

especially during long work hours, and encouraged to partake in physical activity and

stress reduction options. Such interventions could benefit physicians, patients, the

community and the healthcare system at large.

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Supplementary File 1: English translation of the study questionnaire

A survey on health-related behaviors of Israeli physicians

Dear physician

The Israel Medical Association is endeavoring to promote healthier lifestyles among its members. We kindly ask you to dedicate approximately 2 minutes to complete the survey. Your answers will help us understand which interventions might be of value to you. Your privacy and confidentiality is guaranteed.

Sincerely yours,

Leonid Edelman, Chairman

The Israel Medical Association

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1. **In a typical week, how many times do you perform physical activity** such as brisk walking, swimming, running, cycling, body-building exercises, ball games, dance or yoga?

   ❐ Not at all
   ❐ 1
   ❐ 2
   ❐ 3
   ❐ 4
   ❐ 5
   ❐ 6
   ❐ 7

2. **On average, how long is each episode of activity?** _____ minutes

Which of the following questions (numbers 3-9) best describes your nutrition and eating habits?

3. **Eating breakfast**

   ❐ Daily or almost daily
   ❐ 3-4 times a week
   ❐ 1-2 times a week
   ❐ Less than once a week
   ❐ Not at all

4. **Eating lunch during the working day**

   ❐ Daily or almost daily
   ❐ 3-4 times a week
   ❐ 1-2 times a week
   ❐ Less than once a week
   ❐ Not at all

5. **Adherence to the principles of a Mediterranean diet**: intake of vegetables, fruit, legumes, olive oil, nuts, unrefined wheat, fish, poultry and low-fat dairy products.
   - ❒ Daily or almost daily
   - ❒ 3-4 times a week
   - ❒ 1-2 times a week
   - ❒ Less than once a week
   - ❒ Not at all

6. **Drinking 8 cups of water per day**
   - ❒ Daily or almost daily
   - ❒ 3-4 times a week
   - ❒ 1-2 times a week
   - ❒ Less than once a week
   - ❒ Not at all

7. **Eating processed food products**
   - ❒ Daily or almost daily
   - ❒ 3-4 times a week
   - ❒ 1-2 times a week
   - ❒ Less than once a week
   - ❒ Not at all

8. **Drinking sugar-sweetened beverages, including fruit juices**
   - ❒ Daily or almost daily
   - ❒ 3-4 times a week
   - ❒ 1-2 times a week
   - ❒ Less than once a week
   - ❒ Not at all

9. Eating 5 units of fruits and vegetables per day

❐ Daily or almost daily

❐ 3-4 times a week

❐ 1-2 times a week

❐ Less than once a week

❐ Not at all

10. At present, do you smoke cigarettes?

❐ Yes

❐ No

11. In the last month, how many hours, on average, did you spend sleeping?

❐ 5 or less

❐ 6

❐ 7

❐ 8 or more

12. In general, how would you define your health status?

❐ Excellent

❐ Very good

❐ Good

❐ Fair

❐ Poor

13. To what extent do you experience emotional stress?

❐ Very low

❐ Low

❐ Moderate

❐ High

❐ Very high

14. Do you have a regular physician for your personal health?

❒ Yes

❒ No

15. Your gender

❒ Male

❒ Female

16. Your age

❒ <35

❒ 35-44

❒ 45-54

❒ 55-64

❒ 65+

17. For the calculation of body mass index (BMI)

❒ Your height in centimeters is_____ (according to the last measurement that you can recall)

❒ Your weight in kilograms is_____ (according to the last time you stood on the scales)

18. Your main work setting

❒ Hospital

❒ Community (health plan clinics, including self-employment)

❒ Similar work volume in both hospital and community

❒ Other, i.e. ministry of health facilities, managerial or academic position

19. Your level of training

❒ Resident/fellow

❒ Senior

❒ Other

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20. Your medical specialty

❒ Pediatrics

❒ Family medicine

❒ Internal medicine specialties

❒ Surgical specialties

❒ Obstetrics and gynecology

❒ Psychiatry

❒ Anesthesiology

❒ Other____

Thank you for participating in the survey

STROBE Statement—checklist of items that should be included in reports of observational studies (**page no. relates to the marked copy**)

	Item No.	Recommendation	Page No.	Lines
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	4-5,	59-95
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	7-9	117-184
Objectives	3	State specific objectives, including any prespecified hypotheses	9	181, 185-187
Methods				
Study design	4	Present key elements of study design early in the paper	10	189
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	10	190-195
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	10	190-195, 197-8
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10	201-210
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	11	212-224
Bias	9	Describe any efforts to address potential sources of bias	13	249
Study size	10	Explain how the study size was arrived at	12	235-237

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11	212-220
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11	226-230
		(*b*) Describe any methods used to examine subgroups and interactions		
		(*c*) Explain how missing data were addressed		
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed		
		Case-control study—If applicable, explain how matching of cases and controls was addressed		
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy		
		(*e*) Describe any sensitivity analyses		
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12	235-240
		(b) Give reasons for non-participation at each stage		
		(c) Consider use of a flow diagram		
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12	240-242
		(b) Indicate number of participants with missing data for each variable of interest	14,	262-267 + page 16, lines 280-282, +page 18, lines 298-300
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)		
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time		
		Case-control study—Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures		
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	16,	279 + page 18, line 297, +page 20, lines 307-8
		(*b*) Report category boundaries when continuous variables were categorized		
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses		
Discussion				
Key results	18	Summarise key results with reference to study objectives	20	316-348
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22-3	386--405
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	21-2	355-364
Generalisability	21	Discuss the generalisability (external validity) of the study results	23-4	407-415
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2	35-36

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Health-related behaviors and perceptions among physicians: Results from a cross-sectional study

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1

1 **Health-related behaviors and perceptions among physicians: Results from a**

2 **cross-sectional study**

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2

46 **Abstract**

47 **Objectives:** Physicians' demanding work conditions may reduce the time and energy

48 required for maintaining healthy lifestyles. This study examined health-related

49 behaviors, perceived health status and emotional stress among physicians, and analyzed

50 the effects of personal and work characteristics on these endpoints.

51 **Design:** A cross-sectional study using a digital questionnaire.

52 **Setting and participants:** All 25,590 physicians who were members of the Israeli

53 Medical Association in 2015 were invited to participate by email. Of 14,694 who

54 opened the e-mail, 4,832 (32.9%) responded.

55 **Outcome measures:** Survey topics included physical activity (PA), nutrition and

56 eating habits, smoking, sleep, perceived health status and emotional stress, body mass

57 index (BMI) and contact with a regular physician, as well as personal and work

58 characteristics. Uni- and multivariate analyses were performed.

59 **Results**:

60 Of the 4,832 respondents, 21% reported poor or fair health status, 36% felt considerable

61 emotional stress, 57% were overweight or obese (according to BMI $\geq$25 kg/m^2), 71%

62 did not meet the recommended PA level, 79%% did not meet a composite measure of

63 healthy nutrition, 8% were current smokers, 25% slept 5 hours or less, and 57% did not

64 have a regular physician. Residents and hospital physicians reported significantly less

65 healthy lifestyles, lower perceived health status, and higher stress levels, compared with

66 senior and community physicians. Multivariate analysis demonstrated that being female

67 (OR=0.74, CI=0.64-0.85), younger (0.69, 0.64-0.74), having poor nutrition (0.66, 0.55-

68 0.78), not meeting PA targets (0.68, 0.57-0.82), inadequate sleep (0.54, 0.40-0.56), and

69 perceived poor health status (0.48, 0.40-0.56) were significantly associated with high

70 stress levels (p<0.001).

4

71 **Conclusions:** The unfavorable health behaviors reported among Israeli physicians may

72 have negative effects on their health and well-being. An intervention program to help

73 physicians adopt healthier lifestyle is urgently needed.

74 **Keywords:** physicians, healthy lifestyle; health promoting behaviors; stress; health

75 perception.

5

76 **Strengths and limitations of this study**

77 • This national study portrayed the health behaviors of a relatively large

78 number of respondents (n=4,832), the largest of its kind in Israel.

79 • The study questionnaire covered a large number of health behaviors and

80 perceptions, allowing to portray a relatively comprehensive picture of Israeli

81 physicians' wellness.

82 • The physicians were not asked if they undergo regular screening tests as

83 recommended.

84 • A response rate of 33% is a barrier to generalizing the findings to a larger

85 physician population.

86 • Physicians who felt more positive about their health behaviors were more

87 likely to respond to the survey; therefore the actual health status of the

88 physicians would be worse than that described.

6

89 **INTRODUCTION**

90 Non-communicable diseases, comprising mainly cardiovascular diseases, diabetes,

91 cancer and chronic respiratory diseases, are the leading causes of death globally,

92 accounting for 68% of deaths in 2012.[1] The prevalence of lifestyle-related diseases,

93 such as obesity and type-2 diabetes, has risen considerably in the last decades. Two

94 meta-analyses of large cohort studies have demonstrated that a combination of at least

95 four lifestyle factors of the following: obesity, alcohol consumption, smoking,

96 unhealthy nutrition, and not meeting the guidelines for physical activity (PA), was

97 associated with 66% of mortality risk.[2,3] Therefore, promotion of healthy behaviors has

98 become a public health imperative and preventive medicine concern.

99 As a professional group, physicians have a unique opportunity to promote healthy

100 lifestyle. Most adults in western countries meet their physician at least once a year.

101 Moreover, patients view physicians as a reliable and influential source of knowledge

102 and advice regarding health-related behaviors.[4] Physicians with healthy habits are more

103 likely to discuss those habits with their patients, to lead an effective dialogue and to

104 motivate their patients to adopt a healthy lifestyle.[5,6] Frank et al demonstrated that

105 physicians' advice was perceived as more reliable if the physician disclosed his or her

106 own health behaviors with the patient.[7]

107 However, physician health is not self-understood, given the unique work conditions of

108 physicians, including long work shifts and calls, and long weekly work hours

109 compared with the general population. In their leisure time, they often need to

110 dedicate time to remaining up-to-date in their profession. As a result, physicians have

111 greater struggles with work-life balance than do other workers.[8] They might,

112 therefore, lack the time and energy required for maintaining healthy lifestyles.

113 Physicians work in emotionally charged situations, associated with suffering, fears

114   and death, and are exposed to considerable stress. Concerns about physicians' mental

115   health were documented as early as 1883 when Mattison described opium addicts

116   among physicians[9]. In 1973 the American Medical Association published a report that

117   related to psychiatric disorders that might impair physician functioning.[10] Burnout

118   was mentioned as an entity for the first time in 1975 to describe "failure or exhaustion

119   because of excessive demands on energy, strength, or resources" among the staff of

120   alternative self-help clinics in the United States.[11] Burnout among physicians may

121   lead to loss of enthusiasm for work, feelings of cynicism and a low sense of personal

122   accomplishment, despite being highly motivated at the start of their careers.[8,12,13]

123   Physician health and well-being has recently become the focus of international concern

124   as physicians are important "citizens" of the healthcare system. Therefore, their

125   wellness is crucial to its function. Physician ill-health negatively affects productivity,

126   efficiency, quality of patient care and physician retention.[14]

127   The Canadian, British and American Medical Associations, as well as healthcare

128   organizations, have recently begun to recognize the potential health risks involved with

129   the medical profession. They have created programs to address the health needs of their

130   members, such as the British Medical Association counselling service, the Doctor

131   Advisor Service, an online physician health and wellness resource prepared by

132   Canadian physician health and eLearning experts, as well as biennial international

133   conferences on physician health.[15-17]

134   Israel is characterized by a low hospital bed-to-population ratio and a high occupancy

135   rate compared with other Organization for Economic Co-operation and Development

136   (OECD) countries and the European Union (EU) average. The physician-to-population

137   ratio is somewhat lower than that of EU countries, with downward trending.[18] The

138   Israeli healthcare system is characterized by a unique reimbursement mechanism,

8

139   which dictates a "multi-employer" reality, especially for senior hospital physicians,

140   who frequently work full-time as salaried employees in the public system and continue

141   their working day in the evenings as self-employed physicians for a health fund (health

142   maintenance organization) or in their private clinic.[19] The above mentioned

143   combination of deficient infrastructures and unique reimbursement methods creates

144   considerable workloads and possibly also a greater work-life imbalance.

145   Little is known about health and wellbeing in the Israeli physician population. The

146   Israeli Medical Association (IMA) is an independent professional body that represents

147   95% of Israeli physicians. As part of its mission, the IMA has recently initiated efforts

148   to promote health-related behaviors among physicians, including the current study.

149   The objectives of this study were to examine health-related behaviors and perceptions

150   among physicians, and to analyze the effect of personal and work characteristics on

151   these endpoints.

METHODS

Study design and participants

For this cross–sectional study, all IMA members were contacted by email and asked to complete an electronic questionnaire (Online supplementary file 1). The IMA e-mail list comprised 95% of the country's physicians. E-mails were sent in July 2015 with a short cover letter by the IMA president, containing a link to the survey. Three reminders were sent, between July and August 2015, to members who did not open the mail message.

Questionnaire

The digital format dictated the design of a short questionnaire (requiring 120 seconds to complete), suitable for computers or smartphones. The questionnaire was developed in collaboration with IMA senior representatives and a panel of experts from the fields of medicine, medical ethics, health promotion, sports medicine, nutrition and biostatistics. Survey topics included PA (2 questions), nutrition and eating habits (7 questions), smoking (2), sleep (1), perceived health status (1), perceived emotional stress (1), contact with a regular personal physician (1), height and weight for the calculation of body mass index (BMI), as well as personal and work characteristics (8). Questions were based on validated Hebrew and international questionnaires, adapted to the digital format.[20-22] The survey tool was subjected to internal validation by the expert panel and a convenience sample of 30 respondents who were asked to provide feedback on clarity, relevance and other aspects of the tool.

Age, sex and specialty were obtained from IMA members who did not open the mail, to enable comparison of respondents with non-respondents.

10

175 **Definition of variables**

176 Meeting PA guidelines: performing at least 150 minutes of leisure time PA in an

177 average week.

178 A composite "Healthy Nutrition" measure was defined, which included: eating

179 breakfast, eating lunch, following the principles of a Mediterranean diet[23] (consuming

180 fruit and vegetables, whole wheat, legumes, nuts, fish, poultry and low-fat dairy

181 products), consuming 5 units of fruits and vegetables, drinking 8 cups of water - every

182 day or almost every day, consuming processed food or sugary drinks – never or less

183 than once a week. Healthy nutrition was defined as complying with 6 or 7, of the 7

184 parameters.

185 Perceived health status: Physicians were asked: "In general, how would you define your

186 health status?" (excellent, very good, good, fair or poor).

187 Perceived emotional stress: "To what extent do you experience emotional stress?" (very

188 low, low, moderate, high, very high)

189 **Statistical analysis**

190 Continuous variables were summarized as mean and standard deviation. Categorical

191 variables were summarized as number and percentage. Chi square and t-test were

192 employed for univariate analysis and comparisons among subgroups. Logistic

193 regression models were estimated for perceived health and stress status as dependent

194 variables. A binomial variable was defined for the multivariate analysis: for perceived

195 health status: 0=poor or fair; 1=good, very good or excellent; for emotional stress:

196 0=very low, low or moderate; 1=high or very high.

197 **Patient and Public Involvement**

198 It was not appropriate or possible to involve patients or the public in this work as it was

199 not relevant to the research question.

200 **RESULTS**

201 Of 25,590 e-mail addresses that were contacted, 14,694 physicians (57.4%) opened the

202 email, 5,374 clicked on the link to the questionnaire and 4,832 (32.9%) completed and

203 submitted the questionnaire. Since only half of IMA e-mails to the physicians

204 represented by this organization are ever opened by the physicians, we calculated

205 effective response rate as the proportion of physicians who opened the e-mail and

206 submitted the questionnaire. The respondents represent approximately one fifth of all

207 physicians practicing in Israel. Sixty percent of the respondents were males, 36% were

208 44 years of age or younger; 15% were over 65 years.

209 Three parameters were available for comparison of respondents with non-respondents:

210 age, sex, and specialty. Age and sex distributions were similar among respondents and

211 non-respondents. The main specialties of the respondents were internal medicine

212 (19%), surgery and surgical sub-specialties (18%), general practice (13%) and

213 pediatrics (12%). Among non-respondents, specialty distribution differed slightly,

214 however with statistical significance (p<0.0001) (Table 1).

215   **Table 1. Characteristics of respondents and non-respondents (%)**

Variable	Non-respondents N=20,085	Respondents N=4832	P value
Age			
<35	14.5	12.5	
35-44	23.7	23.7	
45-54	21.4	21.4	0.104
55-64	21.3	26.7	
65+	17.5	14.7	
Unknown	1.7	1.1	
Gender			
Female	38.8	40.3	0.161
Male	60.4	59.7	
Medical Specialty			
Pediatrics	12.2	12.8	
General practice	13.1	13.6	
Internal Medicine	20.3	19.3	
Surgical specialties	14.7	17.9	P<0.0001
Anesthesiology	4.4	0.4	
Obstetrics and Gynecology	7.1	8.0	

216   Nineteen percent of the respondents were residents or fellows, 71% were seniors, and

217   8% were not in either of these categories, i.e. did not hold a medical specialty yet were

218   not currently in residency (Table 2). Physicians were asked to state their main work

219   setting – hospital, community or similar work volume in both hospital and community.

220   Fifty-one percent worked in hospitals, 31% in the community and 6% - in both settings.

221   The remainder worked in Ministry of Health facilities and other settings. These data are

222   comparable with national figures that indicate that the main work settings of physicians

223   are the hospital (54%) and the community (39%).[24]

224   Respondents, whose major work setting was the hospital, were younger, more likely

225   male, and more likely in residency, compared with those working in the community;

226   yet senior physicians were the majority (63%) of hospital respondents (Table 2).

227 **Table 2. Demographic characteristics of respondents by work setting (%)**

Main work setting	Hospital N=2,472	Community N=1,482	Combined[a] N=282	Total N=4,832[b]	P Value
Age (years)[c]					
<35	21.5	3.6	4.3	12.5	<0.0001
35-44	30.4	18.7	26.0	23.7	
45-54	19.3	26.3	31.7	21.4	
55-64	21.7	35.1	28.5	26.7	
+65	7.0	16.4	9.6	14.7	
Gender					
Female	36.5	49.1	36.5	40.3	<0.0001
Male	63.5	50.9	63.5	59.7	
Level of training[d]					
Resident/fellow	33.3	5.4	5.3	19.2	<0.0001
Senior	62.9	81.9	86.9	71.3	
Other	3.8	12.7	7.8	8.2	

228 [a] Similar work volume in both hospital and community

229 [b] The "total" column contains data on 596 (12%) of respondents who did not define their

230 main work setting by one of the three major categories (i.e. worked for the Ministry of

231 Health, worked only in a private clinic or in an "unspecified" work setting

232 [c] Age data was missing for 52 (1.1%) of respondents.

233 [d] Data on level of training was missing for 65 (1.3%) of respondents.

14

234   Twenty-one percent reported poor or fair health status, with no significant difference

235   by work place. Thirty-six percent reported a high or very high level of emotional stress.

236   More females reported high stress than males (40.5 and 33.2% respectively, p<0.0001).

237   Residents were the sub-group with the highest stress levels: 49.8% reported high or

238   very high stress, compared with 33.5% of seniors (p<0.0001). The hospital setting was

239   associated with a higher perceived level of considerable stress than the community

240   setting: 43.4% and 30.6%, respectively (p<0.0001) (Table 3). BMI was in the normal

241   range for 41.7% of respondents, with 41.4% and 15.9% overweight and obese,

242   respectively. Overweight and obesity (BMI$\geq$25kg/m^2) were more prevalent among

243   male than female respondents: 67.2% and 42.2%, respectively (p<0.0001) and among

244   those working in the community than the hospital (Table 3).

245   **Table 3. Health status by work setting (%)**

Variable	Hospital N=2,472	Community N=1,482	Combined N=282	Total N=4,832	P Value
Perceived health status[a]					
Excellent	12.0	11.0	11.4	11.1	0.074
Very good	36.0	31.3	35.7	33.5	
Good	32.5	35.9	31.8	33.6	
Fair	17.4	19.9	18.9	18.9	
Poor	2.2	1.9	2.1	2.2	
Perceived level of emotional stress[b]					
Very low	4.8	9.5	7.4	7.6	<0.0001
Low	17.0	20.0	24.5	19.5	
Moderate	34.7	39.9	34.0	36.3	
High	32.8	23.3	24.5	27.1	
Very high	10.6	7.3	9.6	8.8	
Body mass index (BMI)[c]					
Underweight (<18.5 kg/m^2)	1.4	0.5	1.6	1.0	<0.0001
Normal weight (>18.5 to ≤25 kg/m^2)	45.5	37.7	35.9	41.7	
Overweight (>25 to ≤30 kg/m^2)	38.9	43.6	48.4	41.4	
Obese (>30kg/m^2)	14.2	18.1	14.1	15.9	

246   [a]N=4,796; 36 (0.7%) of respondents did not report perceived health status

247   [b]N=4798; 34 (0.7%) of respondents did not report perceived emotional stress

248   [c]N=4,349; 483 (9.0%) of respondents did not report weight and/or height data

16

249   Twenty-eight percent reported not exercising at all, while 29% met the recommended

250   PA target (≥150 minutes weekly). A higher proportion of male than female respondents

251   met the PA target (32.5 and 27.2%, respectively; p<0.0001). Only 15.0% of residents,

252   compared with 34.1% of seniors, met the target. Community physicians were

253   significantly more active (Table 4). Twenty-one percent complied with the "healthy

254   nutrition measure" (6 or 7 of 7 healthy nutrition parameters). Compliance with separate

255   nutritional items is detailed in Table 4. Overall, females had healthier nutritional habits

256   than males. Most eating habits were healthier among community than hospital

257   physicians (Table 4). Among residents, hospital, community, and overall respondents,

258   16%, 10%, 7% and 8.5% were current smokers, respectively. Twenty-five percent

259   reported sleeping 5 hours or less on an average night, while only 23% slept 7 or more

260   hours, as recommended. Only 16% of hospital physicians slept 7 or more hours nightly.

261   Forty-three percent of respondents (38 and 46% in the hospital and community,

262   respectively) had a personal physician on a regular basis.

263   **Table 4. Health-related behavior by work setting (%)**

Variable	Hospital N=2,472	Community N=1,482	Combined N=282	Total N=4,832	P Value
Physical activity in a typical week[a]					
Not exercising	33.8	22.6	29.4	28.0	<0.0001
1-3 times/week	50.9	55.2	56.4	52.3	
4-7 times/week	15.3	22.2	14.2	19.0	
<150 min/week	74.8	65.1	73.1	66.3	<0.0001
≥150 min/week	25.2	34.9	26.9	28.9	
Nutrition & eating habits (every day or almost every day)					
Breakfast	46.6	59.0	45.0	52.7	<0.0001
Lunch	47.2	48.6	38.4	48.5	<0.0001
Mediterranean Diet	30.8	37.1	29.4	33.8	<0.0001
Drinking 8 cups of water	31.1	43.1	32.2	35.9	<0.0001
Processed food	22.4	11.3	19.2	17.5	<0.0001
Sweetened beverages	13.0	8.5	12.5	11.0	<0.0001
5 units of fruits & vegetables	29.0	37.6	28.1	33.1	<0.0001
Cigarette smoking					
Currently	10.1	6.8	9.3	8.5	0.002
Average hours of sleep at night[b]					
≤5 Hours	32.5	17.7	25.3	24.8	<0.0001
6 Hours	51.4	54.5	53.8	50.6	
7 Hours	16.1	27.8	20.9	20.9	
≥8 Hours	1.4	3.2	1.4	2.4	
Has a regular physician for his/her personal health	38.0	46.1	35.6	43.0	<0.0001

264   [a]N=4,600; 232 (4.8%) of respondents did not provide complete information on physical
265   activity

266   [b]N=4,769; 63 (1.3%) of respondents did not report sleeping hours

18

267   The multivariate analysis revealed that the variables younger age, senior status, good

268   nutrition score, meeting the PA target and lower emotional stress were all associated

269   with the perception of good health status. The variables female sex, younger age, poor

270   nutritional habits, not achieving the recommended PA target and inadequate sleep were

271   all associated with high stress levels (Table 5).

272   **Table 5. Results of the logistic regression models for health and stress perceptions**

273   **as dependent variables**

Variable*	B	SE	P Value	OR	95% CI
Perceived health status					
Gender	-0.04	0.09	0.683	0.97	0.79-1.15
Age	-0.36	0.04	<0.0001	0.69	0.63-0.76
Residency	-0.49	0.14	0.001	0.61	0.46-0.80
Stress	-0.46	0.04	<.0001	0.63	0.67-0.58
Nutrition	0.41	0.12	0.001	1.50	1.18-1.91
PA	0.79	0.11	<0.0001	2.24	1.78-2.77
Smoking	-0.07	0.14	0.601	0.92	0.70-1.23
BMI	-0.13	0.01	<0.0001	0.87	0.85-0.89
Perceived level of emotional stress					
Gender	-0.29	0.07	<0.001	0.74	0.64-0.85
Age	-0.36	0.03	<0.001	0.69	0.64-0.74
Residency	-0.096	0.10	0.354	0.90	0.74-1.13
Nutrition	-0.37	0.09	<0.001	0.66	0.55-0.78
PA.	-0.19	0.07	<0.001	0.68	0.57-0.82
Sleep	-0.60	0.09	<0.001	0.54	0.45-0.65
Health status	-0.73	0.08	<0.001	0.48	0.40-0.56

274   BMI=body mass index; CI=confidence interval; OR=odds ratio; PA=physical activity;

275   SEstandard error; OR=odds ratio

276   Gender: male=1, female = 0; Residency: resident = 1 attending = 0; Nutrition: 6-7

277   items of good nutrition, daily or almost daily= 1; others =0; PA: meets PA guidelines

278   =1, others =0; Health status: excellent, very good and good = 1; fair or poor = 0;

279   Emotional stress: very low, low or, moderate =0; high or very high =1.

280

DISCUSSION

282   The results from a national health survey show that health-related behaviors of Israeli

283   physicians are far from optimal. Compared with the Israeli population of similar

284   socioeconomic background,[22,25,26] fewer respondents achieve the recommended PA

285   target, more are overweight, but fewer smoke. Compared with Canadian and US

286   physicians, populations for which these issues have been studied in the last decade,

287   fewer Israeli physicians met PA guidelines, more were overweight or obese and more

288   were current smokers.[21,27,28] Compared with their Canadian colleagues, Israeli

289   physicians tended more frequently to perceive their health as fair or poor, by 2.3 times.[21]

290   Large and comprehensive studies on health promoting behaviors to prevent chronic

291   illness among physicians are few, and use different designs. Canadian and some US

292   studies demonstrated better practices among physicians than comparable general

293   populations.[28,29] However, these findings are not universal: junior British doctors met

294   PA targets less often than the general population;[30] Bahrain primary care physicians

295   were less likely to meet PA targets or to have BMI at the normal range than the general

296   population.[31] In California, more physicians were not exercising at all or exercising only

297   occasionally, and fewer tended to eat breakfast regularly, compared with the adult US

298   population.[32] Seventy-one percent of Australian junior doctors were concerned about

299   their own health.[33]

300   Worldwide, physicians are known as "bad" patients who do not have a regular

301   physician for their personal health. Our finding that two-thirds of hospital-based

302   physicians do not have a regular personal physician supports a previous study that

303   demonstrated that 82% of hospital physicians had been asked by their colleagues to

304   provide "hallway medicine", and 91% of them agreed.[34]

305   High levels of emotional stress have been repeatedly described among physicians. For

306   example, 49% of Canadian female physicians reported usually having high levels of

307   stress;[35] and 70% of Australian junior physicians reported experiencing high levels of

308   stress at work [33]. When left untreated, chronic stress may lead to burnout.[12] West and

309   colleagues listed diverse work-related drivers, such as excessive workload, work

310   inefficiency (i.e. clerical burdens) and loss of control and autonomy as contributors to

311   physician burnout.[36] Hospital-based Chinese physicians with a shift-based schedule and

312   a heavy workload were more susceptible to burnout. Imbalance between high job

313   demand and low self-control indicated a high level of occupational stress exposure.[37]

314   The current study demonstrated higher perceived emotional stress among hospital

315   physicians compared with community-based physicians. In Israel, 61% of the

316   physicians are salaried, 33% are both salaried and self-employed while 6% are

317   exclusively self-employed.[24] Less sense of control over work demands among salaried

318   physicians in the hospital setting, compared with self-employed physicians in the

319   community setting might be related to higher stress. Why do physicians, who enjoy

320   high health literacy, make sub-optimal use of their knowledge and skills to adopt

321   healthy lifestyles? As mentioned above, the reimbursement mechanisms of the Israeli

322   healthcare system   contribute to long work hours.[19] Physicians may therefore lack the

323   time and energy to invest in healthy lifestyles. Unsurprisingly, excessive work hours

324   were associated with lack of exercise, not eating breakfast, less sleeping hours and

325   higher BMI.[28,32]

326   We recently administered the same questionnaire used in the current study to 151

327   second-year medical students (a response rate of 88% from 170 students, mean age

328   24.7, standard deviation 2.7). The students demonstrated considerably better health

329   behaviors than did residents (Wilf Miron R, Comparison between health-related

330   behaviors of medical students and residents). Understanding the nature of the "slippery

331   slope" is of great importance in regard to health-related behaviors along the clinical

332   years of medical school and during residency.

333   Associations shown between achieving PA target and reducing burnout[38] should

334   encourage health organizations as well as individuals to promote and improve lifestyle

335   areas such as PA, nutrition and sleep, for the benefit of health and health perception,

336   and to reduce stress and burnout. Furthermore, improved personal health behaviors of

337   physicians might affect their patients, and thus society at large.[5,6]

338   Following the findings of this study, the IMA has accelerated a number of diverse

339   programs to promote health-related behaviors to prevent chronic illness among its

340   members, such as designating smoking cessation workshops for physicians, guided

341   exercise sessions and personal trainer service for physicians and their spouses, stress

342   and resilience workshops, and a position paper urging the serving of healthy food at

343   staff meetings and conventions. The main findings of the current survey, as well as a

344   list of resources to promote healthy behaviors, have been distributed to all members of

345   the IMA.[39] Physicians were encouraged to ask their organizational managements to

346   improve nutritional options at cafeterias and coffee shops at medical facilities.

347   This study has a number of limitations. A digital survey dictated a relatively short

348   questionnaire. Therefore, important topics such as physician burnout and complying

349   with immunization and health screening were not included. Although the 33% response

350   rate achieved was declared as the highest response rate ever achieved by the IMA in

351   mail surveys among its members, it can be viewed as a barrier to generalizing the

352   findings to a larger physician population. In general, physicians are known as a

353   professional group with low survey response rates, for example, survey response among

354   Canadian physicians was 34.1% and 29.9%, if contacted by regular mail or e-mail,

22

355   respectively.[40] A meta-analysis that compared the response rates of e-mail versus mail

356   surveys found that e-mail surveys generally have lower response rate (about 20% lower

357   on the average) than mail surveys.[41]

358   The respondents of the current survey had similar distributions of sex and age in

359   comparison to non-respondents, but the distribution of specialties was different

360   between these groups. We expect that physicians who felt more positive about their

361   health behaviors would be more likely to respond to the survey. If this was in fact the

362   case, then the actual health status of the physicians would be worse than that described.

363   It should be noted that the current study did not measure some important work-related

364   factors, such as shift work or perceived control over work demands that might be

365   relevant for a policy response.

CONCLUSIONS

367   Our findings raise concern about health behaviors of Israeli physicians and point to

368   the urgent need for preventive and health promotion initiatives. Interventions focusing

369   on two stages of the physician's life may be meaningful: medical training, in which

370   students should be provided with healthy lifestyle knowledge and practical tools to

371   help them implement it; and professional work, with a focus on hospitals. Physicians

372   should be provided with healthier food and beverage options at medical facilities,

373   especially during long work hours, and encouraged to partake in physical activity and

374   stress reduction options. Such interventions could benefit physicians, patients, the

375   community and the healthcare system at large.

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Supplementary File 1: English translation of the study questionnaire

A survey on health-related behaviors of Israeli physicians

Dear physician

The Israel Medical Association is endeavoring to promote healthier lifestyles among its members. We kindly ask you to dedicate approximately 2 minutes to complete the survey. Your answers will help us understand which interventions might be of value to you. Your privacy and confidentiality is guaranteed.

Sincerely yours,

Leonid Edelman, Chairman

The Israel Medical Association

1. **In a typical week, how many times do you perform physical activity** such as brisk walking, swimming, running, cycling, body-building exercises, ball games, dance or yoga?

    ❐ Not at all

    ❐ 1

    ❐ 2

    ❐ 3

    ❐ 4

    ❐ 5

    ❐ 6

    ❐ 7

2. **On average, how long is each episode of activity?** _____ minutes

Which of the following questions (numbers 3-9) best describes your nutrition and eating habits?

3. **Eating breakfast**

    ❐ Daily or almost daily

    ❐ 3-4 times a week

    ❐ 1-2 times a week

    ❐ Less than once a week

    ❐ Not at all

4. **Eating lunch during the working day**

    ❐ Daily or almost daily

    ❐ 3-4 times a week

    ❐ 1-2 times a week

    ❐ Less than once a week

    ❐ Not at all

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5. **Adherence to the principles of a Mediterranean diet**: intake of vegetables, fruit, legumes, olive oil, nuts, unrefined wheat, fish, poultry and low-fat dairy products.

- ❒ Daily or almost daily
- ❒ 3-4 times a week
- ❒ 1-2 times a week
- ❒ Less than once a week
- ❒ Not at all

6. **Drinking 8 cups of water per day**

- ❒ Daily or almost daily
- ❒ 3-4 times a week
- ❒ 1-2 times a week
- ❒ Less than once a week
- ❒ Not at all

7. **Eating processed food products**

- ❒ Daily or almost daily
- ❒ 3-4 times a week
- ❒ 1-2 times a week
- ❒ Less than once a week
- ❒ Not at all

8. **Drinking sugar-sweetened beverages, including fruit juices**

- ❒ Daily or almost daily
- ❒ 3-4 times a week
- ❒ 1-2 times a week
- ❒ Less than once a week
- ❒ Not at all

9. Eating 5 units of fruits and vegetables per day

  ❒ Daily or almost daily

  ❒ 3-4 times a week

  ❒ 1-2 times a week

  ❒ Less than once a week

  ❒ Not at all

10. At present, do you smoke cigarettes?

  ❒ Yes

  ❒ No

11. In the last month, how many hours, on average, did you spend sleeping?

  ❒ 5 or less

  ❒ 6

  ❒ 7

  ❒ 8 or more

12. In general, how would you define your health status?

  ❒ Excellent

  ❒ Very good

  ❒ Good

  ❒ Fair

  ❒ Poor

13. To what extent do you experience emotional stress?

  ❒ Very low

  ❒ Low

  ❒ Moderate

  ❒ High

  ❒ Very high

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14. Do you have a regular physician for your personal health?

❐ Yes

❐ No

15. Your gender

❐ Male

❐ Female

16. Your age

❐ <35

❐ 35-44

❐ 45-54

❐ 55-64

❐ 65+

17. For the calculation of body mass index (BMI)

❐ Your height in centimeters is_____ (according to the last measurement that you can recall)

❐ Your weight in kilograms is_____ (according to the last time you stood on the scales)

18. Your main work setting

❐ Hospital

❐ Community (health plan clinics, including self-employment)

❐ Similar work volume in both hospital and community

❐ Other, i.e. ministry of health facilities, managerial or academic position

19. Your level of training

❐ Resident/fellow

❐ Senior

❐ Other

20. Your medical specialty

❒ Pediatrics

❒ Family medicine

❒ Internal medicine specialties

❒ Surgical specialties

❒ Obstetrics and gynecology

❒ Psychiatry

❒ Anesthesiology

❒ Other_____

Thank you for participating in the survey

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Lines
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	1-2
			3	51
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4	47-73
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6-8	90-148
Objectives	3	State specific objectives, including any prespecified hypotheses	8	149-151
Methods				
Study design	4	Present key elements of study design early in the paper	9	154-155
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9	156-159
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	9	154-156
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9	161-174
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	10	177-190
Bias	9	Describe any efforts to address potential sources of bias	9	175-176
Study size	10	Explain how the study size was arrived at	11	203-205

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10	192-194
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10	192-198
		(*b*) Describe any methods used to examine subgroups and interactions		
		(*c*) Explain how missing data were addressed		
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed		
		Case-control study—If applicable, explain how matching of cases and controls was addressed		
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy		
		(*e*) Describe any sensitivity analyses		

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11	203-210
		(b) Give reasons for non-participation at each stage		
		(c) Consider use of a flow diagram		
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11-13	209-235, Table 1, Table 2
		(b) Indicate number of participants with missing data for each variable of interest		
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)		
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time		
		*Case-control study—*Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures	14-17	236-268, Table 3, Table 4
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	14-18	236-281, Table 3, Table 4, Table 5
		(*b*) Report category boundaries when continuous variables were categorized		
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses		
Discussion				
Key results	18	Summarise key results with reference to study objectives	19	284-292
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	21-22	350-360, 367-369
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19-21 22	284-349 370-379
Generalisability	21	Discuss the generalisability (external validity) of the study results	22	361-366
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2	35-36

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.