EVOLUCIÓN DE LAS RECOMENDACIONES EN ACTIVIDAD FÍSICA EN POBLACIÓN GENERAL

THE LANCET ORIGINAL ARTICLES [SEPT. 25, 1953

CORONARY HEART-DISEASE AND PHYSICAL ACTIVITY OF WORK

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Two questions are discussed in the epidemiology of coronary thrombosis: Study of occupational groups[1] suggests that there has been a true increase of it, and that this is not due simply to an increase of coronary sclerosis. The sclerosis, it seems, is the basic condition in the production of the disease; thrombosis, inflammation and the complex of atheroma, thrombosis, and the sequelæ of the heart to deal with these in relation to the diseased coronary vessels, all need to be studied.

Data have been made from the Social Medicine Research Unit's panel of middle-aged men, coronary disease as a problem in public health, and in the hope of uncovering social factors which may be favourable or unfavourable to the development of the disease. A survey of medical practitioners[2] indicated that such epidemiological study can be carried out with relatively small numbers, and that it may be rewarding. The present report extends this study to other workers and describes the methods used. Certain difficulties referred to in previous papers where the possibilities and limitations of this type of investigation are considered, and points of theory and method are discussed in some detail.

I. CORONARY HEART-DISEASE IN DIFFERENT OCCUPATIONS

London Transport

The occurrence of coronary heart-disease in certain groups of weekly paid employees of London Transport undertakings is described. The groups are those with an assignment between the unit and the Chief Medical Officer and Staff Administration Officer of London Transport Executive, and include drivers and conductors of the Central (" red ") buses, the drivers and motormen of the tramcars and trolley-buses, and the motormen and guards on the Underground railways, who thereof. About 31,000 men, aged 35 to 64, were included. The numbers of persons in the various grades in each grade were large and the groups were homogeneous as regards occupation.

The investigations of this type two sets of facts are required.

1) Facts about all the episodes of coronary heart-disease that were recognized during the period under review, and about the working conditions of the persons concerned.

2) Facts about the " populations " to which those workers belonged.

This information was obtained in the manner described below.

As part of the general study of industrial morbidity being made by the Social Medicine Research Unit, particulars of any diseases for those 31,000 employees are recorded in a Central Record of Staff Statistics maintained by the Industrial Health Department. The records are mainly derived from general practitioners' and hospital certificates, but from the London Transport medical officers who examine men who are away from work for more than a few consecutive week-ends. In addition, cases of heart-disease with absences of any duration are re-examined. All diagnoses are coded by the international three-figure code.[3] Details of all deaths and of all retirements due to ill health are also recorded in the Central Record of Staff Statistics. For the years 1949–51 death certificates were available, as were the diagnoses of the London Transport medical officers for ill-health retirements, and these were also recorded in the Central Record of Staff Statistics to ensure accuracy of data.

By special arrangement for the present inquiry, all absences, for any cause whatsoever, during the years 1949–51 and assigned to any code number from 420 to 434 (inclusive) were reported to the medical departments for detailed scrutiny; and all cases of angina pectoris, coronary thrombosis, coronary sclerosis, and doubtful cases for consideration, were then " notified " to the unit. (It is, of course, to be appreciated that the notification of episodes of the disease, whether occurring on or off duty, were included.)

From the Central Record of Staff Statistics population figures for the groups under review at the beginning and end of each year the investigation covered.

Results

Incidence and Early Mortality

There were 196 men absent because of coronary heart-disease ; we information from industrial sources on

TABLE I.—SIGNS CLINICAL SYMPTOMS (DIAGNOSIS) OF CORONARY HEART-DISEASE IN WEEKLY PAID STAFF [MEN AGED 35–64 (INCLUSIVE)] OF LONDON TRANSPORT EXECUTIVE, 1949–50

Ages (years)	(1) Angina pectoris	(2) Coronary thrombosis (fatal or non-fatal)	(3) Sudden death (coronary thrombosis)	Total Incidence
	Men at risk	Men at risk	Men at risk	Men at risk
No. of cases	per 1,000 p.a.	No. of cases	per 1,000 p.a.	No. of cases	per 1,000 p.a.	No. of cases	per 1,000 p.a.
35–39	0	...	0	...	0	...	0	...
40–44	1	1·1	3	3·2	0	...	4	4·4
45–49	1	1·1	10	11·1	6	6·6	19	21·1
50–54	3	3·3	14	15·4	5	5·5	22	24·2
55–59	11	11·6	15	15·8	5	5·3	31	32·7
60–64	6	7·5	10	12·5	3	3·7	19	23·8
Total no. of cases	22		52		19		113	
Occupational rate per 1,000 p.a.		2·2		2·2		0·7		5·1

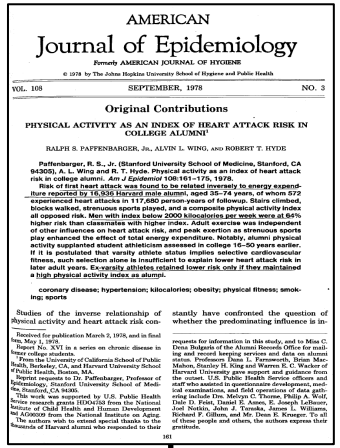
First clinical episode—clinical onset of disease = the first recognizable sign of the disease, whether or not the patient was away from work. This was taken to be the date of the first absence from work. Fatal cases are recorded as such only if they died within 28 days of the first absence from work. Non-fatal cases = those surviving 28 days after the first absence from work. Sudden death = fatal coronary thrombosis with a relative short history (usually less than 24 hours) and with no previous history of angina pectoris. Fatal coronary thrombosis = fatal coronary thrombosis with a history of angina pectoris. Men at risk = the number of men in the group specified in the first column of the table, aged 35 to 64 (inclusive) on January 1st, 1949, and 1950 or 1951 respectively.

The figures in the original presentation is taken from the final diagnosis made and assigned by coronary thrombosis. These were three main types : (1) angina pectoris, or of effort, causing pain on exertion ; (2) coronary thrombosis, fatal or non-fatal, commonly accompanied by severe pain ; (3) sudden death, according to which are included certain deaths from coronary heart-disease which occurred within 24 hours of the onset of symptoms. The occupational rates are standardized for age by the method of Yerushalmy[4] and Hilleboe.[5]

Sudden Deaths.—Data in this report are usually restricted to cases of coronary thrombosis which were known to have survived for 28 days. Inclusion of those who succumbed in the earliest days will be considered, the total rate is largely dependent on the completeness with which the sudden deaths are recorded (3) above.

The rates are standardized for age to permit comparison of the experience of the various groups of workers. The basis is the total number of men in the groups in 1949, 1950, and 1951.

[1] Kahn, R. L., Brit. J. prev. soc. Med., 1951, 5, 1. [2] Morris, J. N., Lancet, 1951, ii, 1111. [3] International Classification of Diseases, 1948. [4] Yerushalmy, J., Human Biology, 1947, 19, 263. [5] Hilleboe, H. E., Journal of Chronic Diseases, 1952, 1, 3.



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Original Contributions

PHYSICAL ACTIVITY AS AN INDEX OF HEART ATTACK RISK IN COLLEGE ALUMNI[1]

RALPH S. PAFFENBARGER, JR., ALVIN L. WING, AND ROBERT T. HYDE

Paffenbarger, R. S., Jr. (Stanford University School of Medicine, Stanford, CA 94305), A. L. Wing and R. T. Hyde. Physical activity as an index of heart attack risk in college alumni. *Am J Epidemiol* **108:161–175, 1978.**

Risk of first heart attack was found to be related inversely to energy expenditure reported by 16,936 Harvard male alumni, aged 35–74 years, of whom 572 experienced heart attacks in 117,680 person-years of followup. Stairs climbed, blocks walked, strenuous sports played, and a composite physical activity index all opposed risk. Men with index below 2000 kilocalories per week were at 64% higher risk than classmates with higher index. Adult exercise was independent of other influences on heart attack risk, and peak exertion as strenuous sports play enhanced the effect of total energy expenditure. Notably, alumni physical activity supplanted student athleticism assessed in college 16–50 years earlier. If it is postulated that varsity athlete status implies selective cardiovascular fitness, such selection alone is insufficient to explain lower heart attack risk in later adult years. Ex-varsity athletes retained lower risk only if they maintained a high physical activity index as adults.

coronary disease; hypertension; kilocalories; obesity; physical fitness; smoking; sports

Studies of the inverse relationship of physical activity and heart attack risk among college students, the University of California School of Public Health, Berkeley, CA, and Harvard University School of Public Health, Boston, MA.

Reprint requests to Dr. Paffenbarger, Professor of Epidemiology, Stanford University School of Medicine, Stanford, CA 94305.

This work was supported by U.S. Public Health Service research grants HD04768 from the National Institute of Child Health and Human Development and HL14388 from the National Heart and Lung Institute.

The authors wish to express their thanks to the thousands of Harvard alumni who responded to their requests for information in this study, and to Miss C. Dena Bolgiels of the Alumni Records Office for mailing and record keeping services and data on alumni deaths. Dr. Ralph S. Paffenbarger, Jr., Dr. Chester W. Mahon, Dorothy H. King and Warren H. O. Wacker of Harvard University gave support and guidance from the outset. U.S. Public Health Service officers and staff who assisted in questionnaire development, medical examinations, and field operations of data gathering include Drs. Melvyn C. Thorne, Philip A. Wolf, Dale D. Feist, Daniel E. Ames, E. Joseph LaBauve, Joel Natkin, John J. Tyroala, James L. Williams, Lawrence J. Gilbow, and Mr. Dean E. Krueger. To all of these people and others, the authors express their gratitude.

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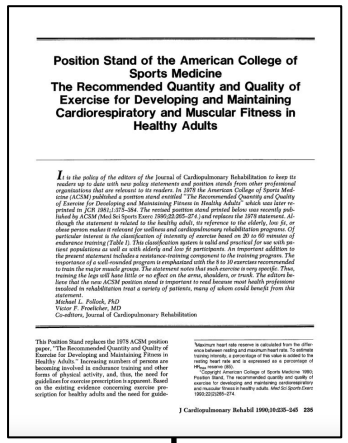
[1] Report No. XVI in a series on chronic disease in former college students.



Position Stand of the American College of Sports Medicine
The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults

It is the policy of the editors of the Journal of Cardiopulmonary Rehabilitation *to keep its readers up to date with new policy statements and position stands from other professional organizations that are relevant to its readers. In 1975 the American College of Sports Medicine (ACSM) published a position stand entitled "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults" which was later reprinted in* Sports Med Bull 10(4):6–10, 1975. *The recommendations stated previous ones issued by ACSM (Med Sci Sports 10(3):vii–x, 1978). Even though the statement is related to the healthy adult, its reference to the elderly, low fit, or obese person makes it relevant for wellness and cardiopulmonary rehabilitation programs. Of particular interest is the classification of intensity of exercise based on 20 to 60 minutes of endurance training (Table 1). This classification system is valid and practical for use with patient populations as well as with elderly and low fit participants. An important addition to the present statement includes a resistance-training component to the training program. The importance of a well-rounded program is emphasized with the 8 to 10 exercises recommended to train the major muscle groups. The statement notes that much exercise is very specific. Thus, training the legs will have little or no effect on the arms, shoulders, or trunk. The editors believe that the new ACSM position stand is important to read because most health professions involved in rehabilitation treat a variety of patients, many of whom could benefit from this statement.*

Michael L. Pollock, PhD
Victor F. Froelicher, MD
Co-editors, Journal of Cardiopulmonary Rehabilitation

This Position Stand replaces the 1975 ACSM position paper, "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults." Increasing numbers of persons are becoming involved in endurance training and other forms of physical activity, and, thus, the need for guidelines for exercise prescription is apparent. Based on the existing evidence concerning exercise prescription for healthy adults and the need for guide-

Telephone heart rate reserve is calculated from the difference between resting and maximum heart rate. To estimate oxygen uptake (oxygen consumption) that is related to the resting heart rate and is expressed as a percentage of HR_{max} reserve (80).

Position Stand. The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness in healthy adults. Med Sci Sports Exerc 1990;22(2)265–274.

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WORK ACTIVITY OF LONGSHOREMEN AS RELATED TO DEATH FROM CORONARY HEART DISEASE AND STROKE*

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Abstract In a 16-year follow-up study after multiphasic screening, 791 of 3260 longshoremen died of coronary disease, and 67 of stroke.

Men with more sedentary jobs expended 825 fewer calories per work day and sustained coronary death rates one third higher than those among cargo handlers. Rate differences were largest at youngest ages and decreased steadily thereafter. Yet heavier cigarette smoking and higher systolic blood pressure had stronger influences in coronary

IN 1951 a large sample of San Francisco longshoremen underwent multiphasic screening examinations[1,2] that included assessment of many characteristics suspected of affecting the incidence of degenerative arterial disease. We have completed a 16-year mortality follow-up study of these men, and report here on the 3083 who were 35 to 64 years of age and on whom job assignment, cigarette habit, blood-pressure level and weight-for-height pattern were determined at the initial examination. Less than 2 per cent of the original sample of longshoremen meeting these criteria were lost to follow-up observation. A total of 808 deaths, including 201 fatal attacks of coronary heart disease and 67 of stroke, were identified in the 44,568 person years of experience. We present death rates from these diseases in terms of single and combined characteristics measured at the initial examination.

Methods

The collective experience of longshoremen was examined on two-level scales of each characteristic studied. Handling cargo versus less active jobs divided the men into groups representing 68 and 32 per cent of the population. Smoking less than one

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package of cigarettes a day or not at all versus smoking one or more packages created groups of 61 and 39 per cent, respectively. Distribution according to five-year age classes more than twice below mean systolic-blood-pressure levels (Table 1) versus those above such levels and screening the totals produced groups of 57 and 43 per cent. Plotting a weight-for-height regression line for each five-year age class (Table 1) divided the longshoremen evenly into the group whose weight for height was below mean level and the group above. The proportions of longshoremen who fell into high-risk levels of each characteristic are given in Table 2.

From official death certificates, we identified 201 coronary (underlying cause 420, International Classification of Diseases, seventh edition) and 67 stroke deaths (35 of cerebrolytic cause 330 or 331, and 32 of cause 332 or 334) occurring during the 16

TABLE 1. *Mean Systolic-Blood-Pressure Levels and Body Weight-for-Height Regression Lines among Longshoremen According to Age at Initial Examination.*

Age (Yr) at 1951	Mean Systolic-Blood-Pressure Level	Regression Line* Weight for height	Slope (b)
35–39	120	69.0	101.5	.055
40–44	126	68.8	102.4	.056
45–49	140	68.1	176.6	.039
50–54	146	68.1	178.7	.035
55–59	144	67.7	179.2	.040
60–64	155	67.6	177.4	.040

*$Y = a' + b'(X - \bar{X})$, where Y is height & X weight of study subjects.

American College of Sports Medicine
Position Statement on

The Recommended Quantity and Quality Of Exercise for Developing and Maintaining Fitness in Healthy Adults

Increasing numbers of persons are becoming involved in endurance training activities and thus, the need for guidelines for exercise prescription is apparent.

Based on the existing evidence concerning exercise prescription for healthy adults and the need for guidelines, the American College of Sports Medicine has developed the following guidelines for the quantity and quality of training for developing and maintaining cardiorespiratory fitness and body composition in the healthy adult:

1. Frequency of training: 3 to 5 days per week.

2. Intensity of training: 50 to 85% of maximum oxygen uptake (V_{O_2} max).

3. Duration of training: 15 to 60 minutes of continuous aerobic activity. Duration is dependent on the intensity of the activity; thus lower intensity activity should be conducted over a longer time period. This takes into account the "dose" and "dose" effect and the fact that it is more readily attained in a longer duration programs, and because of the potential hazards and compliance problems associated with high intensity activity, lower to moderate intensity activity of longer duration is recommended for the average adult.

Whatever mode of activity, any activity that uses large muscle groups, that can be maintained continuously, and is rhythmical and aerobic in nature, e.g. running-jogging, walking-hiking, cross-country skiing, bicycling, rowing, cross-country skiing, rope skipping, and various endurance game activities.

Rationale and Research Background

The following discussion presents enough and what type of exercise is best for developing and maintaining fitness[1], are frequently asked. It is recognized that the term 'physical fitness' is composed of a wide variety of variables included in the broad categories of cardiovascular-respiratory fitness, physique and body composition, muscular strength and endurance, and motor fitness. It is also recognized that the adaptative response to training is complex and includes peripheral, central, structural, and functional factors. Although many such variables and their adaptation response to training have been documented, the lack of information on the dose-response relationship (frequency, intensity, and duration of training) makes it difficult to draw comparative models. Thus, in respect to the above questions, there will be limited to discussion in Yes no, total body mass, fat weight (FW), and lean body weight (LBW) factors.

The following paragraphs is based upon the frequency, intensity, and duration of training, the mode of activity (aerobic in nature, e.g., listed under No. 4 above), and the initial level of fitness. In evaluating these factors, the following observations have been derived from studies conducted with endurance training programs.

1. Improvement in V_{O_2} max is directly related to frequency [1,11,12,16,30,40,57,76], intensity [2,10,11,28,33,37,40,56,77], and duration [3,14,28,40, 56,77,96] of training. Depending upon the quantity and quality of training, improvements in V_{O_2} max can range from 5% to 25% [4,11,37,51,52,56,77,93,102,103]. Generally, the greater the improvement in V_{O_2} max, the greater the gains have been shown, they are usually associated with decreases in total body mass and FW loss, or a low initial level of fitness. Also, as a result of leg fatigue or a lack of motivation, persons with low initial fitness may have spuriously low initial V_{O_2} max values.

2. The amount of improvement in V_{O_2} max tends to plateau when frequency of training is increased above 3 days per week [23,66,69]. For the non-athlete, there is not enough information to indicate if 5 or 6 days per week is better than 3 days per week. Research found in programs that are conducted more than 5 days per week. Participation of less than two days per week does not show an adequate change in V_{O_2} max [34,90,98].

3. Total body mass and FW are generally reduced with endurance training [4,11,12,16,28,30,40,56,77,93,102,103] or increases slightly [34]. Programs that are conducted at least 3 days per week [16,30,61,80,87], of at least 20 minutes duration [40,82,87] and of sufficient intensity and duration to expend approximately 300 kilocalories (Kcal) per session, have been shown to produce significant losses in body mass and FW loss [12,30,82,87]. As expenditure of 300 Kcal per session has also been shown to be useful in weight reduction if the exercise frequency is at least 4 days per week [80]. Programs with less participation generally show little or no change in body mass and FW [11,16,28,40,56,77,93,102,103]. Increases in V_{O_2} max have been shown with 10 to 15 minutes of high intensity training [34,40,66,67,77,78], thus, if total body mass and FW reduction is not a consideration, then short duration, high intensity programs may be recommended for healthy, low risk, young adult populations.

4. The minimal threshold level for improvement in V_{O_2} max is approximately 60% of the maximum heart rate reserve (50% of V_{O_2} max) [31,37]. Maximum heart rate reserve represents the percent difference between resting and maximum heart rate. It is calculated by subtracting the resting heart rate (HR) (accompanied of a wide variety of variables included in the broad categories of cardiovascular-respiratory fitness, physique and body composition, muscular strength and endurance, and motor fitness). It is also recognized that the adaptative response to training is complex and includes peripheral, central, structural, and functional factors. Although many such variables and their adaptation response to training have been documented, the lack of information on the dose-response relationship (frequency, intensity, and duration of training make it difficult to draw comparative models. Thus, in respect to the above questions, there will be limited to discussion in Yes no, total body mass, fat weight (FW), and lean body weight (LBW) factors.

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AHA Medical/Scientific Statement

Position Statement

Statement on Exercise

Benefits and Recommendations for Physical Activity Programs for All Americans

A Statement for Health Professionals by the Committee on Exercise and Cardiac Rehabilitation of the Council on Clinical Cardiology, American Heart Association

Gerald F. Fletcher, MD, Chairman; Steven N. Blair, PhD; James Blumenthal, PhD; Carl Caspersen, PhD; Bernard Chaitman, MD; Stephen Epstein, MD; Harold Falls, PhD; Erika S. Sivarajan Froelicher, PhD, MPH, RN; Victor F. Froelicher, MD; and Ileana L. Pina, MD, Members

Regular aerobic physical activity increases exercise capacity and plays a role in both primary and secondary prevention of cardiovascular disease.[1] The known benefits of regular aerobic exercise and recommendations for implementation of exercise programs for healthy adults and for cardiac patients are reorganized as a risk factor for coronary artery disease.

Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in apparently healthy persons as well as in most patients with cardiovascular disease. Regular physical activity is required to maintain these beneficial effects. The potential risk of physical activity can be reduced by medical evaluation, supervision, and education.

Exercise can help control blood lipid abnormalities, diabetes, and obesity; in addition, aerobic exercise alters metabolism. The exercise-induced increase in high density lipoproteins is strongly associated with changes in body weight.[2] In addition, regular exercise in overweight women and men enhances the beneficial effects of a low-calorie diet on levels of a low-saturated fat and low-cholesterol diet.[3]

Developing endurance, joint flexibility, and muscle strength is important in a comprehensive exercise program, especially as people age. However, static or isometric exercise has been shown to lower aerobic and vascular risk. Patients with cardiovascular disease usually asked to refrain from heavy lifting and forceful isometric exercises, although the use of light weights seems beneficial in developing muscle strength and joint flexibility. Careful isometric training alone or with aerobic training is generally safe and effective in patients with cardiovascular disease when it is medically stable and are in a supervised program.[4–6]

Many activities of daily living require arm work more than leg work. Therefore, patients with coronary artery disease are advised to use their arms as well as their legs in exercise training. The arms respond like the legs to exercise training both quantitatively and qualitatively,

output (the volume of blood ejected by the heart, which determines the amount of blood delivered to the exercising muscles) and the ability to extract oxygen from blood. Beneficial changes in hemodynamic, hormonal, metabolic, neurological, and respiratory function also occur with increased exercise capacity.

Exercise training results in decreased myocardial oxygen demand at any level of physical activity performed, as demonstrated by a decrease in the product of heart rate×systolic arterial blood pressure (an index of myocardial oxygen consumption). These changes are also beneficial in patients with coronary artery disease, who after exercise training may attain a higher level of physical work before reaching the level of myocardial ischemic responses that results in myocardial ischemia.[7–9]

Exercise training favorably alters lipid and carbohydrate metabolism. The exercise-induced increase in high density lipoproteins is strongly associated with changes in body weight.[10] In addition, regular exercise in overweight women and men enhances the beneficial effects of a low-calorie diet on levels of a low-saturated fat and low-cholesterol diet.[11]

"Statement on Exercise" was approved by the American Heart Association Steering Committee on February 10, 1982.
Requests for reprints should be sent to the Office of Scientific Affairs, American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231-4596.

Morris - 1953

- Primeras investigaciones sistemáticas de los riesgos para la salud asociados con un estilo de vida sedentario.
- Diferencias en la incidencia en eventos de cardiopatía isquémica.
- Los conductores > incidencia de cardiopatía isquémica en comparación con los ayudantes (2,7 frente a 1,9 por 1.000 hombres-año de estudio).

THE LANCET] ORIGINAL ARTICLES [NOV. 21, 1953

CORONARY HEART-DISEASE AND PHYSICAL ACTIVITY OF WORK

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OF THE TREASURY MEDICAL SERVICE

THIS report is one of a series on the epidemiology of coronary disease. Study of coronary heart-disease [1-9] suggests that there has been a true increase of it, and that this is not due simply to an increase of coronary atheroma. The atheroma, it seems, is the basic condition of the heart-disease; but other conditions are necessary, and the complex of atheroma, thrombosis, and the capacity of the heart to deal with these in relation to the demands made upon it, all need to be studied.

Surveys have been made from the Social Medicine Research Unit to gain some knowledge of coronary heart-disease as a problem in public health, and in the hope of uncovering social factors which may be favourable or unfavourable to its occurrence. Observations on a group of medical practitioners [12] indicated that such epidemiological study can be carried out with relatively small numbers, and that it may be rewarding. The present report extends this study to other workers and describes the findings among them. Readers are referred to the previous papers where the possibilities and limitations of this type of investigation are considered, and points of theory and method are discussed in some detail.

I. CORONARY HEART-DISEASE IN DIFFERENT OCCUPATIONS

London Transport

The occurrence of coronary heart-disease in certain groups of weekly paid employees of London Transport Executive during 1949 and 1950 was studied by special arrangement between the unit and the Chief Medical Officer and Staff Administration Officer of London Transport Executive. The experience of drivers and conductors of the Central ("red") buses, the drivers and conductors of the trams and trolleybuses, and the motormen and guards on the Underground railways, was observed. About 31,000 men, aged 35 to 64, were included. These groups of staff were chosen because the numbers in each grade were large and the groups were homogeneous as regards occupation.

In investigations of this type two sets of facts are required:

(1) Facts about all the episodes of coronary heart-disease that were recognised during the period under review, and about the workers concerned.
(2) Facts about the "populations" to which these workers belonged.

This information was obtained in the manner described below.

As part of the general study of industrial morbidity being made by the London Transport Executive,[19] all sickness absences of any duration for these 31,000 employees are recorded in a Central Record of Staff Statistics maintained by the Staff Administration Officer. Medical diagnoses are obtained from general practitioners' and hospital certificates, and from the London Transport medical officers who examine men before they return to work if their absence exceeds twenty-eight days. In addition, cases of heart-disease with absences of any duration are so examined. All diagnoses are coded by the international three-figure code.[8] Details of all deaths and of all retirements due to ill health are also recorded and the medical causes are similarly coded. Copies of the death certificates were available, as were the diagnoses of the London Transport medical officers for ill-health retirements. Routine checks are imposed in the Central Record of Staff Statistics to ensure accuracy of data.

By special arrangement for the present inquiry, all absences, ill-health retirements, and deaths, the diagnoses of which were assigned to any code number from 420 to 454 (inclusive) were reported to the medical department for detailed scrutiny; and cases of coronary heart-disease, presumptively atherosclerotic, and doubtful cases for consideration, were then "notified" to the unit. (It is, of course, to be appreciated that all clinical presentations of the disease, whether occurring on or off duty, were included.)

From the Central Record of Staff Statistics population counts in appropriate age-groups for each occupational group were available at the beginning and end of each year the investigation covered.

RESULTS

Incidence and Early Mortality

Men may retire from work because of coronary heart-disease; so information from industrial sources on

TABLE I—FIRST CLINICAL EPISODES (INCIDENCE) OF CORONARY HEART-DISEASE IN WEEKLY PAID STAFF (MEN AGED 35–64 INCLUSIVE) OF LONDON TRANSPORT EXECUTIVE, 1949–50

Ages (years)	(1) Angina pectoris		"Coronary thrombosis" (2) Coronary occlusion—myocardial infarction		"Coronary thrombosis" (3) Immediate mortality		Total incidence	
	No. of cases	*Rate per 1000 p.a.*	No. of cases	*Rate per 1000 p.a.*	No. of cases	*Rate per 1000 p.a.*	No. of cases	*Rate per 1000 p.a.*
35–39	0	..	2	..	0	..	2	..
40–44	1	..	3	*0·3*	2	..	6	*0·6*
45–49	1	..	12	*1·1*	6	*0·6*	19	*1·8*
50–54	3	*0·3*	14	*1·4*	9	*1·0*	26	*2·9*
55–59	11	*1·6*	13	*1·9*	8	*1·2*	32	*4·6*
60–64	6	*1·2*	19	*3·8*	9	*1·8*	34	*6·9*
Total no. of cases	22		63		34		119	
Standardized rate at ages 35–64 incl.		*0·4*		*1·2*		*0·7*		*2·3*

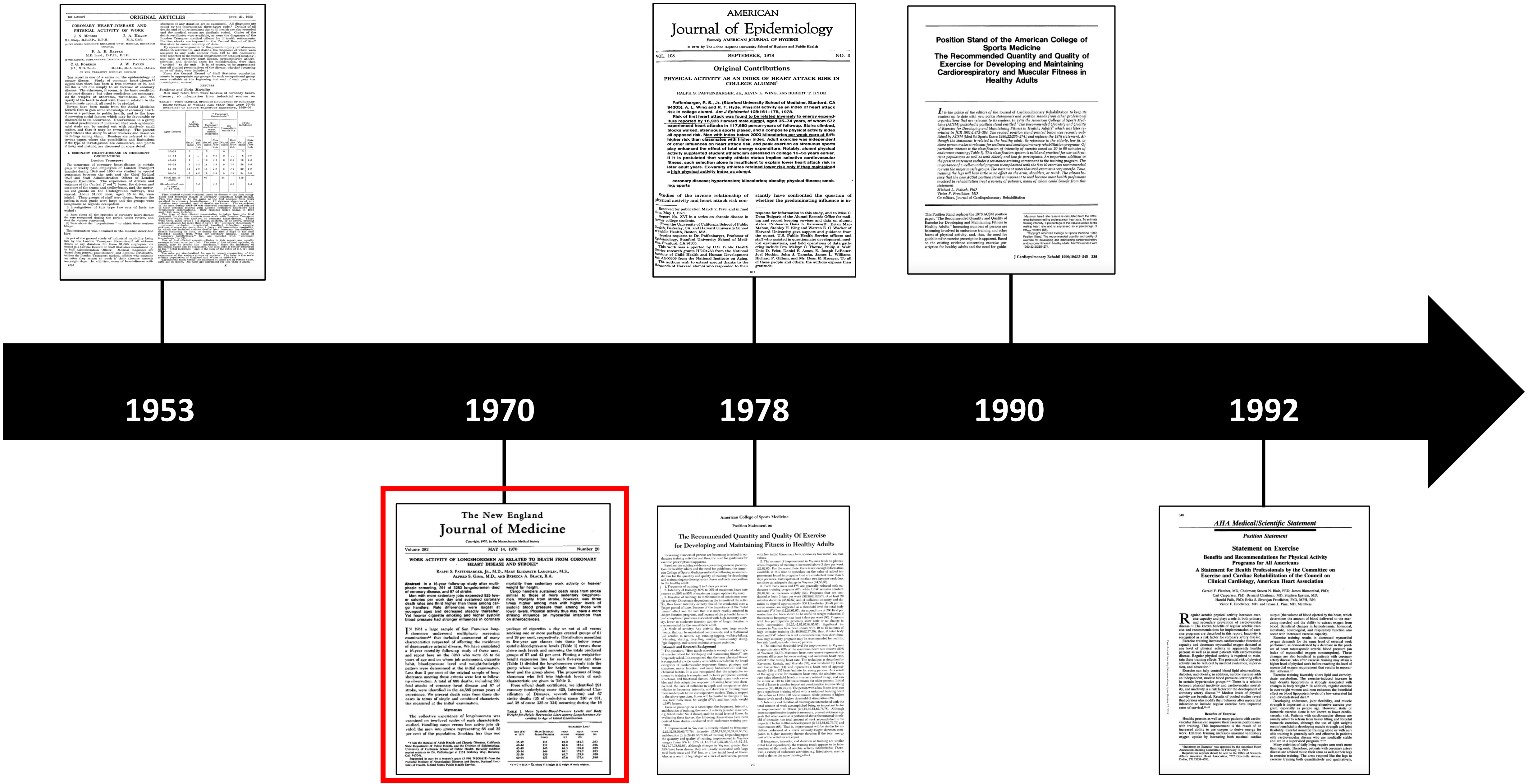
First clinical episode—clinical onset of disease—the first recognised and recorded attack of coronary (ischæmic) heart-disease. This was taken to be the same as the first absence from work ascribed to coronary heart-disease. All sickness absences of any duration were recorded, and all deaths are known. The experience of the men during 1949–50 was observed concurrently, and related to their personal records with London Transport Executive and predecessor organisations. Only episodes which began in 1949 and 1950 were included.

The type of first clinical presentation is taken from the final diagnosis for the first absence from work with London Transport Executive which was ascribed to coronary heart-disease. There were three main types: (1) angina pectoris, or of effort, causing sickness absence for more than 3 days; (2) "coronary thrombosis"—coronary occlusion—myocardial (cardiac) infarction, causing sickness absence for more than 3 days; (3) immediate mortality, in which are included sudden deaths from coronary heart-disease, deaths occurring on duty, or during the first 3 days of the first recorded absence from work for coronary disease. Cases of "coronary insufficiency," &c., are included with "coronary thrombosis" in (2).

Rate of first clinical episode.—Rates in this report are usually average annual rates per 1000. The rate of first clinical episode, or attack, may be termed the "incidence." Since the incidence of individual types will be considered, the total rate is better described as the "total incidence" and is the sum of the rates of (1), (2), and (3) above.

The *rates* are standardised for age to permit comparison of the experience of the various groups of workers. The base is the male civilian population of England and Wales in mid-1949.

Throughout these tables the numbers of cases are in roman type, *rates are in italics*. No *rates* are calculated for less than 3 cases.


ORIGINAL ARTICLES
CORONARY HEART-DISEASE AND PHYSICAL ACTIVITY OF WORK
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AHA Medical/Scientific Statement
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Paffenbarger – 1970

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WORK ACTIVITY OF LONGSHOREMEN AS RELATED TO DEATH FROM CORONARY HEART DISEASE AND STROKE*

RALPH S. PAFFENBARGER, JR., M.D., MARY ELIZABETH LAUGHLIN, M.S., ALFRED S. GIMA, M.D., AND REBECCA A. BLACK, B.A.

Abstract In a 16-year follow-up study after multiphasic screening, 291 of 3263 longshoremen died of coronary disease, and 67 of stroke.

Men with more sedentary jobs expended 925 fewer calories per work day and sustained coronary death rates one third higher than those among cargo handlers. Rate differences were largest at youngest ages and decreased steadily thereafter. Yet heavier cigarette smoking and higher systolic blood pressure had stronger influences in coronary mortality than sedentary work activity or heavier weight for height.

Cargo handlers sustained death rates from stroke similar to those of more sedentary longshoremen. Mortality from stroke, however, was three times higher among men with higher levels of systolic blood pressure than among those with lower levels. Physical activity thus may have a more striking influence on myocardial infarction than on atherosclerosis.

IN 1951 a large sample of San Francisco longshoremen underwent multiphasic screening examinations[1,2] that included assessment of many characteristics suspected of affecting the incidence of degenerative arterial disease. We have completed a 16-year mortality follow-up study of these men, and report here on the 3263 who were 35 to 64 years of age and on whom job assignment, cigarette habit, blood-pressure level and weight-for-height pattern were determined at the initial examination. Less than 2 per cent of the original sample of longshoremen meeting these criteria were lost to follow-up observation. A total of 888 deaths, including 291 fatal attacks of coronary heart disease and 67 of stroke, were identified in the 44,585 person years of experience. We present death rates from these diseases in terms of single and combined characteristics measured at the initial examination.

METHODS

The collective experience of longshoremen was examined on two-level scales of each characteristic studied. Handling cargo versus less active jobs divided the men into groups representing 68 and 32 per cent of the population. Smoking less than one package of cigarettes a day or not at all versus smoking one or more packages created groups of 61 and 39 per cent, respectively. Distribution according to five-year age classes into those below mean systolic-blood-pressure levels (Table 1) versus those above such levels and summing the totals produced groups of 57 and 43 per cent. Plotting a weight-for-height regression line for each five-year age class (Table 1) divided the longshoremen evenly into the group whose weight for height was below mean level and the group above. The proportions of longshoremen who fell into high-risk levels of each characteristic are given in Table 2.

From official death certificates, we identified 291 coronary (underlying cause 420, International Classification of Diseases, seventh edition) and 67 stroke deaths (35 of underlying cause 330 or 331, and 32 of cause 332 or 334) occurring during the 16

TABLE 1. *Mean Systolic-Blood-Pressure Levels and Body Weight-for-Height Regression Lines among Longshoremen According to Age at Initial Examination.*

AGE (YR) IN 1951	MEAN SYSTOLIC-BLOOD-PRESSURE LEVEL	REGRESSION LINE*		
		MEAN HEIGHT (C)	MEAN WEIGHT (C)	SLOPE (b)
35-39	136	69.0	181.3	.033
40-44	137	68.8	182.4	.036
45-49	140	68.3	178.8	.039
50-54	144	68.1	178.7	.035
55-59	150	67.7	179.9	.030
60-64	153	67.6	177.4	.040

*$Y = C + B(X - \bar{X}_L)$ where Y is height & X weight of study subjects.

*From the Bureau of Adult Health and Chronic Diseases, California State Department of Public Health, and the Division of Epidemiology, University of California School of Public Health, Berkeley (address reprint requests to Dr. Paffenbarger at 2151 Berkeley Way, Berkeley, Cal. 94704).

Supported in part by a research grant (5 P01 NB06818) from the National Institute of Neurological Diseases and Stroke, National Institutes of Health, United States Public Health Service.

- En el estudio de los trabajadores portuarios de San Francisco (1970)
- Comparó las tasas de mortalidad por infarto y enfermedad coronaria de los estibadores con los empleados de oficina.
- Los estibadores experimentaron una tasa de mortalidad coronaria un cuarto más baja que los empleados menos activos.

THE LANCET ORIGINAL ARTICLES [SEPT. 25, 1953

CORONARY HEART-DISEASE AND PHYSICAL ACTIVITY OF WORK

J. N. MORRIS, M.R.C.P., D.P.H.
J. A. HEADY, M.A. Oxon
OF THE SOCIAL MEDICINE RESEARCH UNIT, MEDICAL RESEARCH COUNCIL
P. A. B. RAFFLE, M.D. Lond., D.P.H., D.I.H.
AT THE HOSPITAL DEPARTMENT, LONDON TRANSPORT EXECUTIVE
C. G. ROBERTS, B.A., M.D. Camb.
J. W. PARRY, M.B.E., M.D. Camb., D.C.H.
OF THE TRANSPORT MEDICAL SERVICE

Two questions are considered in the epidemiology of coronary thrombosis: Study of occupational data[1] suggests that there has been a true increase of it, and that this is not due simply to an increase of coronary sclerosis. The sclerosis, it seems, is the basic condition in the production of the disease; thrombosis, inflammation and the ectopic of atheroma, thresholds, and the quantity of the heart to deal with illness in relation to the physical work upon it, all need to be studied.

Coronary thrombosis records from the Social Medicine Research Unit's panel of occupations[2] and coronary heart-disease as a problem in public health, and in the hope of uncovering social factors which may be favourable or unfavourable to health, in the hope of finding new methods of medical practitioners.[3] indicated that such epidemiological study can be carried out with relatively small records, and that it may be rewarding. The present report extends this study to other workers and describes the methods used. The difficulties are discussed, and previous papers where the possibilities and limitations of this type of investigation are considered, and points of theory and method are discussed in some detail.

1. CORONARY HEART-DISEASE IN DIFFERENT OCCUPATIONS

London Transport

The occurrence of coronary heart-disease in certain groups of weekly paid employees of London Transport has been described.[2] The present study of the social assignment between the unit and the Chief Medical Officer and Staff Administration Officer of London Transport. The records of the Medical Service of the executive of the Central ("red") buses, the drivers and conductors of the trams and trolleybuses, and the motormen and guards on the Underground railways, was classed. About 31,000 men, aged 35 to 64, were employed in these occupations, and the records of examination in each grade were large and the groups were homogeneous as regards occupation.

The investigations of this type two sets of facts are required.

1) Facts about all the episodes of coronary heart-disease (or were recognized during the period under review, and were the working conditions.

2) Facts about the "populations" to which those workers belonged.

This information was obtained in the manner described below.

As part of the general study of industrial morbidity being made by the Social Medicine Research Unit, the records of any duration for those 31,000 employees are handed to a Central Record of Staff Statistics maintained by the Hospital Department of London Transport. Records are created from general practitioners' and hospital certificates, but from the London Transport medical officers who examine men who are away from work for more than seven consecutive days. In addition, cases of heart-disease with absences of any duration are re-examined. All diagnoses are coded by the international three-figure code.[4] Details of all deaths and of all retirements due to ill health are also recorded by the Central Record of Staff Statistics. Since full death certificates were available, as were the diagnoses of the London Transport medical officers for ill-health retirements, the records were considered adequate for the Central Record of Staff Statistics to ensure accuracy of data.

By special arrangement for the present inquiry, all absences, for any cause, amounting to a total of 7 days or more in any year assigned to any code number from 420 to 434 (inclusive) were reported to the medical departments for detailed scrutiny; and all deaths, whether certified as coronary thrombosis, coronary sclerosis, and doubtful cases for consideration, were then "notified" to the unit. (It is, of course, to be appreciated that the notification preceded the death, whether occurring on or off duty, were included.)

From the Central Record of Staff Statistics population tables for the occupational groups in which coronary thrombosis were available at the beginning and end of each year the investigation covered.

RESULTS

Incidence and Early Mortality

The 31,000 men were followed because of coronary heart-disease; no information from industrial sources on

TABLE I.—SUDDEN CLINICAL SYNDROMES (DIAGNOSED) OF CORONARY HEART-DISEASE IN WORKERS PAID STAFF [MEN AGED 35-64 (INCLUSIVE)] OF LONDON TRANSPORT EXECUTIVE, 1949–50

Ages (years)	(1) Angina pectoris	(2) Coronary thrombosis not fatal	(3) Coronary thrombosis fatal	Total Incidence
	No. of men	Rate per 1,000 p.a.	No. of men	Rate per 1,000 p.a.	No. of men	Rate per 1,000 p.a.	No. of men	Rate per 1,000 p.a.
35–39	0	...	0	...	0	...	0	...
40–44	1	...	0	0·0	0	0·0	1	0·4
45–49	1	...	10	3·1	6	1·9	19	5·8
50–54	3	0·9	14	4·4	5	1·6	22	6·9
55–59	11	3·6	15	4·9	5	1·7	32	8·8
60–64	6	2·0	10	3·3	3	1·0	24	8·0
Total no. of cases	22		49		24		119	
Occupational rate per 1,000 p.a.		0·4		1·0		0·5		2·3

First clinical episode—clinical onset of disease = the first recognized sign of disease. Fatal cases = those dying within 28 days. Data were taken to 31st March, 1950, for all persons from whom death certificates were available, and all deaths are known. The experience of the 31,000 men was followed for 31,000 man-years. Rates are based on these person-years, with 95 per cent. confidence limits. Rates for 1949 and 1950 were included.

The first clinical episode presenting to notice from the final diagnosis made was assigned to coronary thrombosis. These were then made types: (1) angina pectoris, or of effort, causing the patient to stop work; (2) coronary thrombosis, not fatal within a month; (3) coronary thrombosis, fatal within a month, in which was included sudden death from coronary heart-disease, defined as death within 24 hours of the onset of symptoms. Rates are standardized for age to permit comparison of the experience of the various groups of workers. The basis is the total experience of the 31,000 men between the ages of 35 and 64 (inclusive) of London Transport executive, 1949–50.

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Original Contributions

PHYSICAL ACTIVITY AS AN INDEX OF HEART ATTACK RISK IN COLLEGE ALUMNI[1]

RALPH S. PAFFENBARGER, JR., ALVIN L. WING, AND ROBERT T. HYDE

Paffenbarger, R. S., Jr. (Stanford University School of Medicine, Stanford, CA 94305), A. L. Wing and R. T. Hyde. Physical activity as an index of heart attack risk in college alumni. *Am J Epidemiol* **108:161–175, 1978.**

Risk of first heart attack was found to be related inversely to energy expenditure reported by 16,936 Harvard male alumni, aged 35–74 years, of whom 572 experienced heart attacks in 117,680 person-years of followup. Stairs climbed, blocks walked, strenuous sports played, and a composite physical activity index all opposed risk. Men with index below 2000 kilocalories per week were at 64% higher risk than classmates with higher index. Adult exercise was independent of other influences on heart attack risk, and peak exertion as strenuous sports play enhanced the effect of total energy expenditure. Notably, alumni physical activity supplanted student athleticism assessed in college 16–50 years earlier. If it is postulated that varsity athlete status implies selective cardiovascular fitness, such selection alone is insufficient to explain lower heart attack risk in later adult years. Ex-varsity athletes retained lower risk only if they maintained a high physical activity index as adults.

coronary disease; hypertension; kilocalories; obesity; physical fitness; smoking; sports

Studies of the inverse relationship of physical activity and heart attack risk among college students,

[1] From the Department of Health, Education, and Welfare, Public Health Service, Health Services and Mental Health Administration, Division of Chronic Disease Control, Stanford University School of Medicine, Stanford, CA 94305, and Harvard University School of Public Health, Boston, MA.

Reprint requests to Dr. Paffenbarger, Professor of Epidemiology, Stanford University School of Medicine, Stanford, CA 94305.

This work was supported by U.S. Public Health Service research grants HD04768 from the National Institute of Child Health and Human Development and HL18823 from the National Heart and Lung Institute.

The authors wish to express their thanks to the residents of Harvard alumni who responded to their requests for information in this study, and to Miss C. Dena Bolgiels of the Alumni Records Office for mailing and record keeping services and data on alumni deaths. Dr. Ralph S. Paffenbarger, Jr., Dr. Chung-Cheng Hsieh, Dr. Melvyn C. Thorne, Philip A. Wolf, Dale D. Feist, Daniel F. Ames, E. Joseph LeBauer, Joel Notkin, John J. Tarnuka, James L. Williams, Stephen C. Gilbow, and Mr. Dean E. Krueger. To all of these people and others, the authors express their gratitude.

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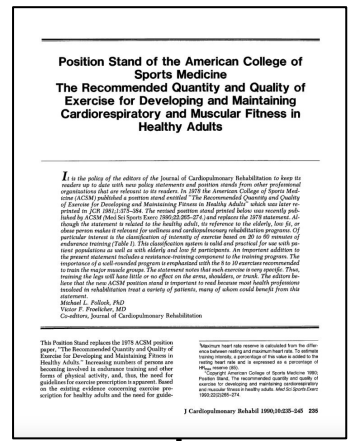

Position Stand of the American College of Sports Medicine
The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults

It is the policy of the editors of the Journal of Cardiopulmonary Rehabilitation *to keep its readers up to date with new policy statements and position stands from other professional organizations that are relevant to its readers. In 1975 the American College of Sports Medicine (ACSM) published a position stand entitled "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults" which was later reprinted in* Sports Med 3(6):413–423, 1986. *The original position stand printed below was originally published in* JCSM (Med Sci Sports Exerc 10(3):vii–x, 1978). *Since the material is published, though the statement is related to the healthy adult, its reference to the elderly, low fit, or obese person makes it relevant for wellness and cardiopulmonary rehabilitation programs. Of particular interest is the classification of intensity of exercise based on 20 to 60 minutes of endurance training (Table 1). This classification system is valid and practical for use with patient populations as well as with elderly and low fit participants. An important addition to the present statement includes a resistance-training component to the training program. The importance of a well-rounded program is emphasized with the 8 to 10 exercises recommended to train the major muscle groups. The statement notes that much exercise is very specific. Thus, training the legs will have little or no effect on the arms, shoulders, or trunk. The editors believe that the new ACSM position stand is important to read because most health professions involved in rehabilitation treat a variety of patients, many of whom could benefit from this statement.*

Michael L. Pollock, PhD
Victor F. Froelicher, MD
Co-editors, Journal of Cardiopulmonary Rehabilitation

This Position Stand replaces the 1978 ACSM position paper, "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults." Increasing numbers of persons are becoming involved in endurance training and other forms of physical activity, and, thus, the need for guidelines for exercise prescription is apparent. Based on the existing evidence concerning exercise prescription for healthy adults and the need for guide-

Telephone heart rate reserve is calculated from the difference between resting and maximum heart rate. To estimate oxygen uptake (V̇O2) from heart rate, one must add 3.5 to the resting heart rate and x expressed as a percentage of HR$_{max}$ reserve (80).

Position Stand. The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults. Med Sci Sports Exerc 1990;22(2)265–274.

J Cardiopulmonary Rehabil 1990;10:235–245 235

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WORK ACTIVITY OF LONGSHOREMEN AS RELATED TO DEATH FROM CORONARY HEART DISEASE AND STROKE*

RALPH S. PAFFENBARGER, JR., M.D., MARY ELIZABETH LAUGHLIN, M.S., ALFRED S. GIMA, M.D., AND REBECCA A. BLACK, B.A.

Abstract In a 16-year follow-up study after multiphasic screening, 791 of 3260 longshoremen died of coronary disease, and 67 of stroke.

Men with more sedentary jobs expended 825 fewer calories per work day and sustained coronary death rates one third higher than those among cargo handlers. Rate differences were largest at youngest ages and decreased steadily thereafter. Yet heavier cigarette smoking and higher systolic blood pressure had stronger influences in coronary

IN 1951 a large sample of San Francisco longshoremen underwent multiphasic screening examinations[1,2] that included assessment of many characteristics suspected of affecting the incidence of degenerative arterial disease. We have completed a 16-year mortality follow-up study of these men, and report here on the 3,261 who were 35 to 64 years of age and on whom job assignment, cigarette habit, blood-pressure level and weight-for-height pattern were determined at the initial examination. Less than 2 per cent of the original sample of longshoremen meeting these criteria were lost to follow-up observation. A total of 808 deaths, including 201 fatal attacks of coronary heart disease and 67 of stroke, were identified in the 44,568 person years of experience. We present death rates from these diseases in terms of single and combined characteristics measured at the initial examination.

METHODS

The collective experience of longshoremen was examined on two-level scales of each characteristic studied. Handling cargo versus less active jobs divided the men into groups representing 60 and 32 per cent of the population. Smoking less than one

* From the Bureau of Adult Health and Chronic Diseases, California State Department of Public Health, Berkeley (Dr. Paffenbarger), and the University of California School of Public Health, Berkeley (address reprint requests to Dr. Paffenbarger at 2151 Berkeley Way, Berkeley, CA 94704).

Supported in part by a research grant (5 PH 76)HE04768 from the National Institute of Neurological Diseases and Stroke, National Institutes of Health, United States Public Health Service.

mortality than sedentary work activity or heavier weight for height.

Cargo handlers sustained death rates from stroke similar to those of more sedentary longshoremen. Mortality from stroke, however, was three times higher among men with higher levels of systolic blood pressure than among those with lower levels. Physical activity thus may have a more striking influence on myocardial infarction than on atherosclerosis.

package of cigarettes a day or not at all versus smoking one or more packages created groups of 61 and 39 per cent, respectively. Distribution according to five-year age classes more than twice below mean systolic-blood-pressure levels (Table 1) versus those above such levels and screening the totals produced groups of 57 and 43 per cent. Plotting a weight-for-height regression line for each five-year age class (Table 1) divided the longshoremen evenly into the group whose weight for height was below mean level and the group above. The proportions of longshoremen who fell into high-risk levels of each characteristic are given in Table 2.

From official death certificates, we identified 201 coronary (underlying cause 420, International Classification of Diseases, seventh edition) and 67 stroke deaths (35 of cerebrolytic cause 330 or 331, and 32 of cause 332 or 334) occurring during the 16

TABLE 1. *Mean Systolic-Blood-Pressure Levels and Body Weight-for-Height Regression Lines among Longshoremen According to Age at Initial Examination.*

Age (Yr) at 1951	Mean Systolic-Blood-Pressure Level	Regression Line* Weight for height	Weight (lb)
35–39	120	69.0	107.5
40–44	126	68.8	112.4
45–49	140	68.1	118.6
50–54	146	68.1	119.7
55–59	150	67.7	119.4
60–64	155	67.6	119.4

* $Y = c' + b'(X - \bar{X})$, where Y is height in ft, weight of study subjects.

1978

American College of Sports Medicine
Position Statement on

The Recommended Quantity and Quality Of Exercise for Developing and Maintaining Fitness in Healthy Adults

Increasing numbers of persons are becoming involved in endurance training activities and thus, the need for guidelines for exercise prescription is apparent.

Based on the existing evidence concerning exercise prescription for healthy adults and the need for guidelines, the American College of Sports Medicine has developed the following guidelines for the quantity and quality of training for developing and maintaining cardiorespiratory fitness and body composition in the healthy adult:

1. Frequency of training: 3 to 5 days per week.

2. Duration of training: 15 to 60 minutes of continuous aerobic activity. Duration is dependent on the intensity of the activity; thus lower intensity activity should be conducted over a longer time period. Duration should be sufficient to provide a "stress" effect and the fact that it is more readily attained in longer duration programs, and because of the potential hazards and compliance problems associated with high intensity activity, lower to moderate intensity activity of longer duration is recommended for the average adult.

3. Mode of activity: Any activity that uses large muscle groups, that can be maintained continuously, and is rhythmical and aerobic in nature, e.g. running-jogging, walking-hiking, swimming, skating, bicycling, rowing, cross-country skiing, jump skipping, and various endurance game activities.

Rationale and Research Background

The amount (duration and frequency) and mode (and what type of exercise is best for developing and maintaining fitness)[1], are frequently asked. It is recognized that the term "physical fitness" is composed of a wide variety of variables included in the broad categories of cardiovascular-respiratory fitness, physique and body composition, and the various components of muscular and skeletal fitness. It is also recognized that the adaptative response to training is complex and includes peripheral, central, structural, and functional factors. Although many such variables and their adaptation response to training have been documented, the lack of information on the dose-response relationship (frequency, intensity, and duration of training) makes prescription difficult to use as comparative models. Then, in respect to the above questions, there will be varied responses in Vo$_2$ max, total body mass, fat weight (FW), and lean body weight (LBW) factors.

1. Improvement in training is based upon the frequency, intensity, and duration of training, the mode of activity (aerobic in nature, e.g., listed under No. 3 above), and the initial level of fitness. In evaluating these factors, the following observations have been derived from studies conducted with endurance training programs.

2. Improvement in Vo$_2$ max is directly related to frequency [1,11,12,16,30,40,77,78], intensity [2,10,11,28,33,37,40,76,77], and duration [1,14,28,40, 56,77,80] of training. Depending upon the quantity and quality of training, improvement in Vo$_2$ max can range from 5% to 25% [4,11,27,31,32,33,36,40,42,52,53,76,77,78,80]. Generally, those who are initially less than 25% lean tissue, they are usually associated with a decrease in total body mass and FW loss, or a low initial level of fitness. Also, as a result of leg fatigue or a lack of motivation, persons with low initial fitness may have spuriously low initial Vo$_2$ max values.

3. The amount of improvement in Vo$_2$ max tends to plateau when frequency of training is increased above 3 days per week [23,66,69]. For the non-athlete, there is not enough information to indicate if 2 days per week is sufficient. Studies of the development found in programs that are conducted more than 5 days per week. Participation of less than two days per week does not show an adequate change in Vo$_2$ max [34,36,66].

4. Total body mass and FW are generally reduced with endurance training programs [11,12,16,28,30,40,42,52,53,56,76,77,78,80,87], or increases slightly [34]. Programs that are conducted at least 3 days per week [16,30,61,66,87], of at least 20 minutes duration [40,42,87] and of sufficient intensity and duration to expend approximately 300 kilocalories (Kcal) per session, are most effective in reducing FW [11,12,16,28,30,40,42,52,53,56,76,77,78,80,87]. As expenditure of 300 Kcal per session has also been shown to be useful in weight reduction if the exercise frequency is at least 4 days per week [66]. Programs with less participation generally show little or no change in total body mass or FW [2,10,11,16,28,30,40,42,52,53,56,76,77,78,80,87]. Increases in Vo$_2$ max have been shown with 10 to 15 minutes of high intensity training [34,40,66,67,77,78], thus, if total body mass and FW reduction is not a consideration, then short duration, high intensity programs may be recommended for healthy, young, well motivated persons.

4. The minimal threshold level for improvement in Vo$_2$ max is approximately 60% of the maximum heart rate reserve (50% of Vo$_2$ max) [31,37]. Maximum heart rate reserve represents the percent difference between resting and maximum heart rate. Telephone heart rate reserve, a method of estimating Vo$_2$ max from heart rate, has been shown [87], was validated by Davis Karvonen, Kentala, and Wuorela [37], was validated by Davis [23], and represents a heart rate of approximately 130 to 150 beats/minute for young persons. As a result of the aging curve for maximum heart rate, the absolute heart rate value (beats/min) for training will decrease as one grows older, but as low as 130 to 150 beats/minute for older persons, below the age of 65, is a more important consideration in prescribing exercise [16, 40,48,75,77]. The person with a low fitness level can get a significant training effect with a sustained training heart rate as low as 110 to 120 beats/minute when the person's initial fitness levels need a higher threshold of stimulation [28].

5. Improvement in Vo$_2$ max is generally accompanied with the total amount of work accomplished being an important factor in improvement in fitness [2,7,32,40,61,62,76,79]. Although more comprehensive inquiry is necessary, present evidence suggests that when exercise is performed above the minimal threshold level, the total work accomplished is probably the most important factor in fitness development [7,17,61,62,76,79] and maintenance [69]. That is, improvement will be similar for activities performed at a lower intensity-longer duration compared to higher intensity-shorter duration if the total energy cost of the activities are similar.

If frequency, intensity, and duration of training are similar (total Kcal expenditure), the training result appears to be independent of the mode of aerobic activity [30,59,82,84]. Therefore, a variety of endurance activities, e.g. listed above, may be used to derive the same training effect.

"Statement on Exercise" was approved by the American Heart Association Steering Committee on February 10, 1982.

Requests for reprints should be sent to the Office of Scientific Affairs, American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231-4596.

1990

Position Stand of the American College of Sports Medicine
The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults

It is the policy of the editors of the Journal of Cardiopulmonary Rehabilitation *to keep its readers up to date with new policy statements and position stands from other professional organizations that are relevant to its readers. In 1975 the American College of Sports Medicine (ACSM) published a position stand entitled "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults" which was later reprinted in* Sports Med 3(6):413–423, 1986. *The original position stand printed below was originally published in* JCSM (Med Sci Sports Exerc 10(3):vii–x, 1978). *Since the material is published, though the statement is related to the healthy adult, its reference to the elderly, low fit, or obese person makes it relevant for wellness and cardiopulmonary rehabilitation programs. Of particular interest is the classification of intensity of exercise based on 20 to 60 minutes of endurance training (Table 1). This classification system is valid and practical for use with patient populations as well as with elderly and low fit participants. An important addition to the present statement includes a resistance-training component to the training program. The importance of a well-rounded program is emphasized with the 8 to 10 exercises recommended to train the major muscle groups. The statement notes that much exercise is very specific. Thus, training the legs will have little or no effect on the arms, shoulders, or trunk. The editors believe that the new ACSM position stand is important to read because most health professions involved in rehabilitation treat a variety of patients, many of whom could benefit from this statement.*

Michael L. Pollock, PhD
Victor F. Froelicher, MD
Co-editors, Journal of Cardiopulmonary Rehabilitation

This Position Stand replaces the 1978 ACSM position paper, "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults." Increasing numbers of persons are becoming involved in endurance training and other forms of physical activity, and, thus, the need for guidelines for exercise prescription is apparent. Based on the existing evidence concerning exercise prescription for healthy adults and the need for guide-

Telephone heart rate reserve is calculated from the difference between resting and maximum heart rate. To estimate oxygen uptake (V̇O2) from heart rate, one must add 3.5 to the resting heart rate and x expressed as a percentage of HR$_{max}$ reserve (80).

Position Stand. The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults. Med Sci Sports Exerc 1990;22(2)265–274.

J Cardiopulmonary Rehabil 1990;10:235–245 235

1992

AHA Medical/Scientific Statement

Position Statement

Statement on Exercise

Benefits and Recommendations for Physical Activity Programs for All Americans

A Statement for Health Professionals by the Committee on Exercise and Cardiac Rehabilitation of the Council on Clinical Cardiology, American Heart Association

Gerald F. Fletcher, MD, Chairman; Steven N. Blair, PED; James Blumenthal, PhD; Carl Caspersen, PhD; Bernard Chaitman, MD; Stephen Epstein, MD; Harold Falls, PhD; Erika S. Sivarajan Froelicher, PhD, MPH, RN; Victor F. Froelicher, MD; and Ileana L. Pina, MD, Members

Regular aerobic physical activity increases exercise capacity and plays a role in both primary and secondary prevention of cardiovascular disease.[1] The known benefits of regular aerobic exercise and recommendations for implementation of exercise programs for healthy adults and for cardiac patients are reorganized as a risk factor for coronary artery disease.

Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in apparently healthy persons as well as in most patients with cardiovascular disease. Regular physical activity is required to maintain these beneficial effects. The potential risk of physical activity can be reduced by medical evaluation, supervision, and education.

Exercise can help control blood lipid abnormalities, diabetes, and obesity; in addition, exercise creates an independent, modest blood pressure–lowering effect in certain hypertensive groups.[2–4] There is a relation between physical activity and the development of osteoporosis, and inactivity is a risk factor for the development of coronary artery disease.[5,6] Modest levels of physical activity are beneficial. Results of pooled studies reveal that persons who modify their behavior after myocardial infarction to include regular exercise have improved rates of survival.[7–10]

Benefits of Exercise

Healthy persons as well as many patients with cardiovascular disease can improve their exercise performance with training. This improvement is the result of an increased ability to use oxygen to derive energy for work. Exercise training increases maximal ventilatory oxygen uptake by increasing both maximal cardiac output (the volume of blood ejected by the heart, which determines the amount of blood delivered to the exercising muscles) and the ability to extract oxygen from blood. Beneficial changes in hemodynamic, hormonal, metabolic, neurological, and respiratory function also occur with increased exercise capacity.

Exercise training results in decreased myocardial oxygen demand at any level of physical activity when performed, as demonstrated by a decrease in the product of heart rate×systolic arterial blood pressure (an index of myocardial oxygen consumption). These changes are also beneficial in patients with coronary artery disease, who after exercise training may attain a higher level of physical work before reaching the level of myocardial ischemia (pain requirement that results in myocardial ischemia).[11]

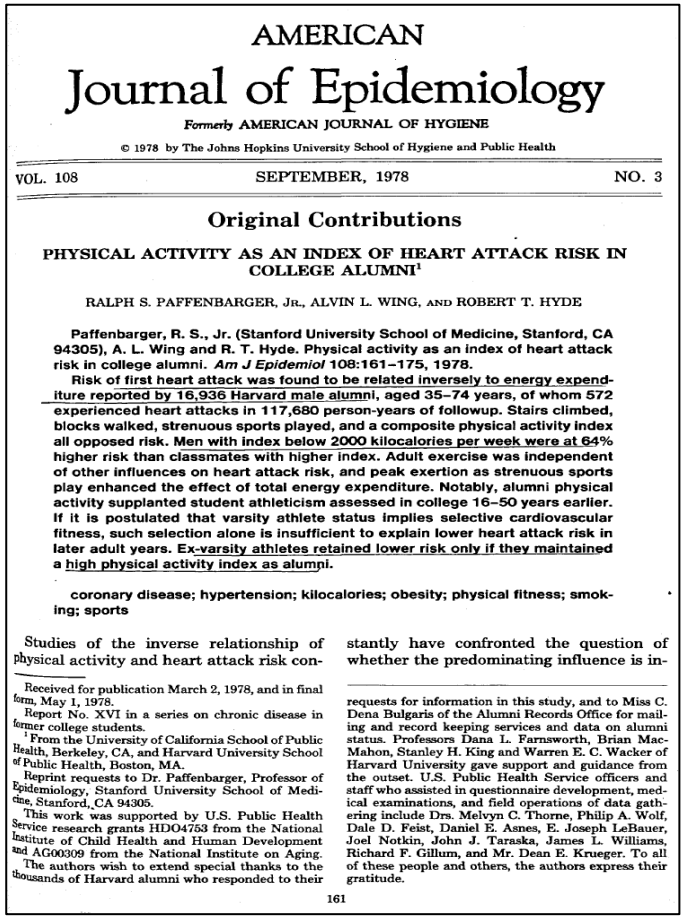
Exercise training favorably alters lipid and carbohydrate metabolism. The exercise-induced increase in high density lipoproteins is strongly associated with changes in body weight.[12] In addition, regular exercise in overweight women and men enhances the beneficial effects of a low-calorie diet on levels of a low-saturated fat and low-cholesterol diet.[13]

Developing endurance, joint flexibility, and muscle strength is important in a comprehensive exercise program, especially as people age. However, static or isometric exercise has been shown to lower resting myocardial oxygen uptake. Patients with cardiovascular disease usually asked to refrain from heavy lifting and forceful isometric exercises, although the use of light weights seems beneficial in developing muscle strength and joint flexibility. Careful isometric training alone or with aerobic training is generally safe and effective in patients with cardiovascular disease when it is moderately static and are in a supervised program.[14–16]

Many activities of daily living require arm work more than leg work. Therefore, patients with coronary artery disease are advised to use their arms as well as their legs in exercise training. The arms respond like the legs to exercise training both quantitatively and qualitatively,

Paffenbarger – 1978

- 17,000 Exalumnos de Harvard (1916-68)
- El riesgo sufrir un primer infarto estaba inversamente asociado con el gasto energético.



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Journal of Epidemiology
Formerly AMERICAN JOURNAL OF HYGIENE

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Original Contributions

PHYSICAL ACTIVITY AS AN INDEX OF HEART ATTACK RISK IN COLLEGE ALUMNI[1]

RALPH S. PAFFENBARGER, JR., ALVIN L. WING, AND ROBERT T. HYDE

Paffenbarger, R. S., Jr. (Stanford University School of Medicine, Stanford, CA 94305), A. L. Wing and R. T. Hyde. Physical activity as an index of heart attack risk in college alumni. *Am J Epidemiol* 108:161–175, 1978.

Risk of first heart attack was found to be related inversely to energy expenditure reported by 16,936 Harvard male alumni, aged 35–74 years, of whom 572 experienced heart attacks in 117,680 person-years of followup. Stairs climbed, blocks walked, strenuous sports played, and a composite physical activity index all opposed risk. Men with index below 2000 kilocalories per week were at 64% higher risk than classmates with higher index. Adult exercise was independent of other influences on heart attack risk, and peak exertion as strenuous sports play enhanced the effect of total energy expenditure. Notably, alumni physical activity supplanted student athleticism assessed in college 16–50 years earlier. If it is postulated that varsity athlete status implies selective cardiovascular fitness, such selection alone is insufficient to explain lower heart attack risk in later adult years. Ex-varsity athletes retained lower risk only if they maintained a high physical activity index as alumni.

coronary disease; hypertension; kilocalories; obesity; physical fitness; smoking; sports

Studies of the inverse relationship of physical activity and heart attack risk constantly have confronted the question of whether the predominating influence is in-

Received for publication March 2, 1978, and in final form, May 1, 1978.
Report No. XVI in a series on chronic disease in former college students.
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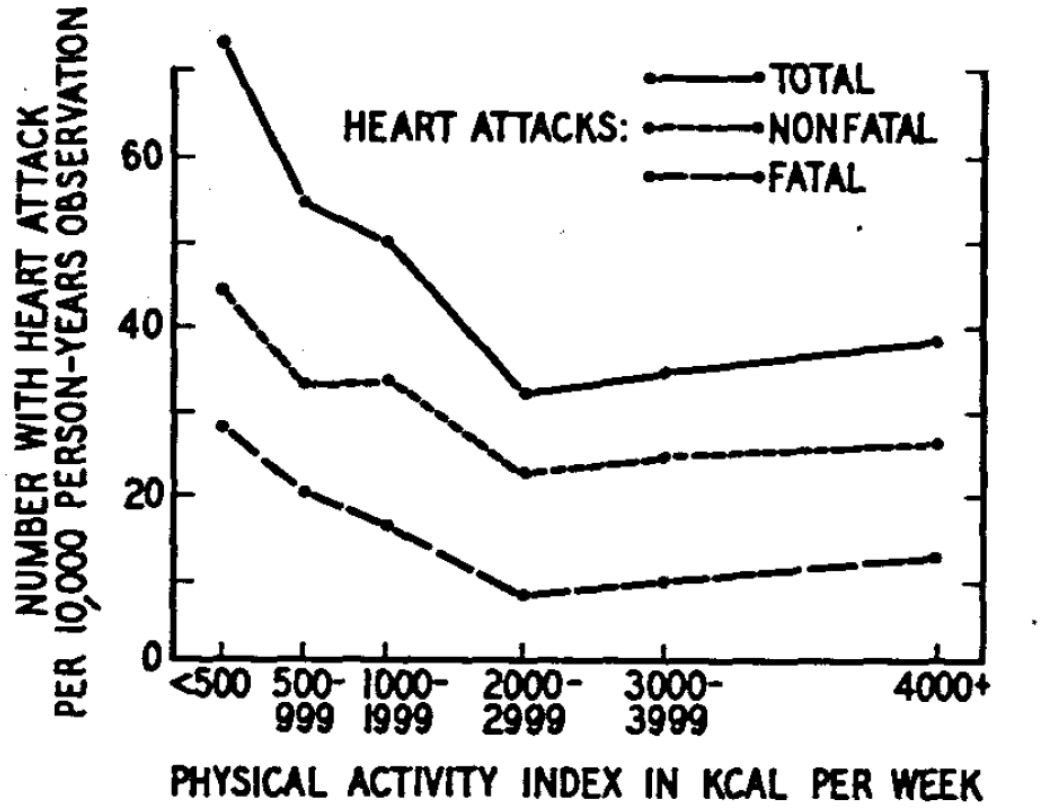
This work was supported by U.S. Public Health Service research grants HDO4753 from the National Institute of Child Health and Human Development and AG00309 from the National Institute on Aging.
The authors wish to extend special thanks to the thousands of Harvard alumni who responded to their requests for information in this study, and to Miss C. Dena Bulgaris of the Alumni Records Office for mailing and record keeping services and data on alumni status. Professors Dana L. Farnsworth, Brian MacMahon, Stanley H. King and Warren E. C. Wacker of Harvard University gave support and guidance from the outset. U.S. Public Health Service officers and staff who assisted in questionnaire development, medical examinations, and field operations of data gathering include Drs. Melvyn C. Thorne, Philip A. Wolf, Dale D. Feist, Daniel E. Asnes, E. Joseph LeBauer, Joel Notkin, John J. Taraska, James L. Williams, Richard F. Gillum, and Mr. Dean E. Krueger. To all of these people and others, the authors express their gratitude.

Paffenbarger – 1978



THE LANCET ORIGINAL ARTICLES [SEPT. 25, 1953

CORONARY HEART-DISEASE AND PHYSICAL ACTIVITY OF WORK

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1970

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WORK ACTIVITY OF LONGSHOREMEN AS RELATED TO DEATH FROM CORONARY HEART DISEASE AND STROKE*

RALPH S. PAFFENBARGER, JR., M.D., MARY ELIZABETH LAUGHLIN, M.S., ALFRED S. GIMA, M.D., AND REBECCA A. BLACK, B.A.

Abstract In a 16-year follow-up study after multiphasic screening, 791 of 3260 longshoremen died of coronary disease, and 67 of stroke.

Men with more sedentary jobs expended 825 fewer calories per work day and sustained coronary death rates one third higher than those among cargo handlers. Rate differences were largest at youngest ages and decreased steadily thereafter. Yet heavier cigarette smoking and higher systolic blood pressure had stronger influences in coronary mortality than sedentary work activity or heavier weight for height.

Cargo handlers sustained death rates from stroke similar to those of more sedentary longshoremen. Mortality from stroke, however, was three times higher among men with higher levels of systolic blood pressure than among those with lower levels. Physical activity thus may have a more striking influence on myocardial infarction than on atherosclerosis.

IN 1951 a large sample of San Francisco longshoremen underwent multiphasic screening examinations[1,2] that included assessment of many characteristics suspected of affecting the incidence of degenerative arterial disease. We have completed a 16-year mortality follow-up study of these men, and report here on the 3263 who were 35 to 64 years of age and on whom job assignment, cigarette habit, blood-pressure level and weight-for-height pattern were determined at the initial examination. Less than 2 per cent of the original sample of longshoremen meeting these criteria were lost to follow-up observation. A total of 888 deaths, including 201 fatal attacks of coronary heart disease and 67 of stroke, were identified in the 44,568 person years of experience. We present death rates from these diseases in terms of single and combined characteristics measured at the initial examination.

METHODS

The collective experience of longshoremen was examined on two-level scales of each characteristic studied. Handling cargo versus less active jobs divided the men into groups representing 60 and 32 per cent of the population. Smoking less than one package of cigarettes a day or not at all versus smoking one or more packages created groups of 61 and 39 per cent, respectively. Distribution according to five-year age classes more than twice below mean systolic-blood-pressure levels (Table 1) versus those above such levels and screening the totals produced groups of 57 and 43 per cent. Plotting a weight-for-height regression line for each five-year age class (Table 1) divided the longshoremen evenly into the group whose weight for height was below mean level and the group above. The proportions of longshoremen who fell into high-risk levels of each characteristic are given in Table 2.

From official death certificates, we identified 201 coronary (underlying cause 420, International Classification of Diseases, seventh edition) and 67 stroke deaths (35 of cerebrolytic cause 330 or 331, and 32 of cause 332 or 334) occurring during the 16

TABLE 1. *Mean Systolic-Blood-Pressure Levels and Body Weight-for-Height Regression Lines among Longshoremen According to Age at Initial Examination.*

Age (Yr) at 1951	Mean Systolic-Blood-Pressure Level	Regression Line* Weight (lb)	Height (in)	Years (N)
35-39	120	69.0	181.5	.055
40-44	126	68.8	182.4	.056
45-49	140	68.1	178.6	.059
50-54	146	68.1	178.7	.055
55-59	151	67.7	177.2	.053
60-64	155	67.6	179.4	.049

*"Y = c' + B (X − X̄), where Y is height in ft, weight of study subjects.

1978

American College of Sports Medicine

Position Statement on

The Recommended Quantity and Quality Of Exercise for Developing and Maintaining Fitness in Healthy Adults

Increasing numbers of persons are becoming involved in endurance training activities and thus, the need for guidelines for exercise prescription is apparent.

Based on the existing evidence concerning exercise prescription for healthy adults and the need for guidelines, the American College of Sports Medicine has developed the following indication for the quantity and quality of training for developing and maintaining cardiorespiratory fitness and body composition in the healthy adult:

1. Frequency of training: 3 to 5 days per week.

2. Intensity of training: 50 to 85% of maximum oxygen uptake (V_{O_2} max).

3. Duration of training: 15 to 60 minutes of continuous aerobic activity. Duration is dependent on the intensity of the activity; thus lower intensity activity should be conducted over a longer time period. This recommendation is based on the "training" effect and the fact that it is more readily attained in longer duration programs, and because of the potential hazards and compliance problems associated with high intensity activity, lower to moderate intensity activity of longer duration is recommended for the average adult.

4. Mode of activity: Any activity that uses large muscle groups, that can be maintained continuously, and is rhythmical and aerobic in nature, e.g. running-jogging, walking-hiking, swimming, skating, bicycling, rowing, cross-country skiling, jump skipping, and various endurance game activities.

Rationale and Research Background

The above "Position Statement" on the quantity and what type of exercise is best for developing and maintaining fitness[1], are frequently asked. It is recognized that the term "physical fitness" is composed of a wide variety of variables included in the broad categories of cardiovascular-respiratory fitness, physique and body composition, and the various components of muscular and skeletal factors. It is also recognized that the adaptative response to training is complex and includes peripheral, central, structural, and functional factors. Although many such variables and their adaptation response to training have been documented, the lack of sufficient data on dose-response (that is, frequency, intensity, and duration of training make comparisons difficult or impossible. Then, in respect to the above questions, fitness will be limited to changes in V_{O_2} max, total body mass, fat weight (FW), and lean body weight (LBW) factors.

The above prescription is based upon the frequency, intensity, and duration of training, the mode of activity (aerobic in nature, e.g. listed under No. 4 above), and the initial level of fitness. In evaluating these factors, the following observations have been derived from studies conducted with endurance training programs.

1. Improvement in V_{O_2} max is directly related to frequency [1,11,12,16,20,60,77,78], intensity [2,10,11,20,33,37,40,76,77], and duration [1,14,20,46, 56,77,86] of training. Depending upon the quantity and quality of training, improvements in V_{O_2} max can range from 5% to 25% [4,11,37,51,52,53,76,77,82,83]. Although V_{O_2} max is usually improved more than 25% have been shown, they are usually associated with a reduction in total body mass and FW loss, or a low initial level of fitness. Also, as a result of leg fatigue or a lack of motivation, persons with low initial fitness may have spuriously low initial V_{O_2} max values.

2. The amount of improvement in V_{O_2} max tends to plateau when frequency of training is increased above 3 days per week [23,66,69]. For the non-athlete, there is not enough information to determine if V_{O_2} max will plateau at 3 days per week. One experiment found in programs that are conducted more than 3 days per week. Participation of less than two days per week does not show an adequate change in V_{O_2} max [58,90,91].

3. Total body mass and FW are generally reduced with endurance training [4,11,12,16,20,37,40,46,51,52,53,56,76,77,78,82,83,87], or increases slightly [54]. Programs that are conducted at least 3 days per week [16,20,40,61,82,87], of at least 20 minutes duration [40,82,87] and of sufficient intensity and duration to expend approximately 300 kilocalories (Kcal) per session, have been shown to be useful in reducing FW [16,20,40,61,82,87] and FW loss [12,20,82,87]. As expenditure of 300 Kcal per session has also been shown to be useful in weight reduction if the exercise frequency is at least 4 days per week [90]. Programs with less participation generally show little or no change in total body mass [1,2,10,11,12,16,20,33,37,40,46,51,52,53,56,76,77,78,82,83,87]. Increases in V_{O_2} max have been shown with 10 to 15 minutes of high intensity training [34,40,60,67,77,78], thus, if total body mass and FW reduction is not a consideration, then short duration, high intensity programs may be recommended for healthy, young, well motivated individuals.

4. The minimal threshold level for improvement in V_{O_2} max is approximately 60% of the maximum heart rate reserve (50% of V_{O_2} max) [33,37]. Maximum heart rate reserve represents the percent difference between resting and maximum heart rate. Added to the resting heart rate is the training heart rate (THR). Karvonen, Kentala, and Mustala [37] was validated by Davis [20] and Pollock [66], and represents a heart rate of approximately 150 to 155 beats/minute for young persons. As a result of the aging curve for maximum heart rate, the absolute heart rate value (beats/minute) for training will tend to be lower by as little as 10 to 20 beats/minute for older persons. Initial fitness level is another important consideration in prescribing exercise [16, 40,46,75,77]. The person with a low fitness level can get a significant training effect with a sustained training heart rate as low as 110 to 120 beats/minute while persons with high fitness levels need a higher threshold of stress [20].

5. Improvements in V_{O_2} max are highly correlated with the total amount of work accomplished being an important factor in improvement in fitness [2,7,32,40,61,82,76,79]. Although more comprehensive inquiry is necessary, present evidence suggests that when exercise is performed above the minimal threshold [20], the total work accomplished is more important than the important factor in fitness development [2,7,32,61,82,76,79] and maintenance [69]. That is, improvement will be similar for activities performed at a lower intensity-longer duration compared to higher intensity-shorter duration if the total energy cost of the activities are similar.

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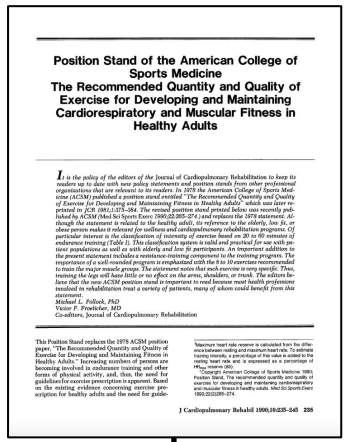

Position Stand of the American College of Sports Medicine
The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults

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J Cardiopulmonary Rehabil 1990;10:235–245 235

1992

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AHA Medical/Scientific Statement

Position Statement

Statement on Exercise

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Gerald F. Fletcher, MD, Chairman; Steven N. Blair, PhD; James Blumenthal, PhD; Carl Caspersen, PhD; Bernard Chaitman, MD; Stephen Epstein, MD; Harold Falls, PhD; Erika S. Sivarajan Froelicher, PhD, MPH, RN; Victor F. Froelicher, MD; and Ileana L. Pina, MD, Members

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"Statement on Exercise" was approved by the American Heart Association Steering Committee on February 10, 1992.
Requests for reprints should be sent to the Office of Scientific Affairs, American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231-4596.

ACSM - 1978

American College of Sports Medicine

Position Statement on

The Recommended Quantity and Quality Of Exercise for Developing and Maintaining Fitness in Healthy Adults

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1. Frequency of training: 3 to 5 days per week.
2. Intensity of training: 60% to 90% of maximum heart rate reserve or, 50% to 85% of maximum oxygen uptake (Vo_2 max).
3. Duration of training: 15 to 60 minutes of continuous aerobic activity. Duration is dependent on the intensity of the activity, thus lower intensity activity should be conducted over a longer period of time. Because of the importance of the "total fitness" effect and the fact that it is more readily attained in longer duration programs, and because of the potential hazards and compliance problems associated with high intensity activity, lower to moderate intensity activity of longer duration is recommended for the non-athletic adult.
4. Mode of activity: Any activity that uses large muscle groups, that can be maintained continuously, and is rhythmical and aerobic in nature, e.g. running-jogging, walking-hiking, swimming, skating, bicycling, rowing, cross-country skiing, rope skipping, and various endurance game activities.

Rationale and Research Background

The questions, "How much exercise is enough and what type of exercise is best for developing and maintaining fitness?", are frequently asked. It is recognized that the term 'physical fitness' is composed of a wide variety of variables included in the broad categories of cardiovascular-respiratory fitness, physique and structure, motor function, and many histochemical and biochemical factors. It is also recognized that the adaptative response to training is complex and includes peripheral, central, structural, and functional factors. Although many such variables and their adaptative response to training have been documented, the lack of sufficient in-depth and comparative data relative to frequency, intensity, and duration of training make them inadequate to use as comparative models. Thus, in respect to the above questions, fitness will be limited to changes in Vo_2 max, total body mass, fat weight (FW), and lean body weight (LBW) factors.

Exercise prescription is based upon the frequency, intensity, and duration of training, the mode of activity (aerobic in nature, e.g. listed under No. 4 above), and the initial level of fitness. In evaluating these factors, the following observations have been derived from studies conducted with endurance training programs.

1. Improvement in Vo_2 max is directly related to frequency (2,23,32,58,59,65,77,79), intensity (2,10,15,26,33,37,42,56,77), and duration (3,14,29,49, 56,77,86) of training. Depending upon the quantity and quality of training, improvement in Vo_2 max ranges from 5% to 25% (4,13,27,31,35,36,43,45,52,53, 62,71,77,78,82,86). Although changes in Vo_2 max greater than 25% have been shown, they are usually associated with large total body mass and FW loss, or a low initial level of fitness. Also, as a result of leg fatigue or a lack of motivation, persons with low initial fitness may have spuriously low initial Vo_2 max values.
2. The amount of improvement in Vo_2 max tends to plateau when frequency of training is increased above 3 days per week (23,62,65). For the non-athlete, there is not enough information available at this time to speculate on the value of added improvement found in programs that are conducted more than 5 days per week. Participation of less than two days per week does not show an adequate change in Vo_2 max (24,56,62).
3. Total body mass and FW are generally reduced with endurance training programs (67), while LBW remains constant (62,67,87) or increases slightly (54). Programs that are conducted at least 3 days per week (58,59,61,62,87), of at least 20 minutes duration (48,62,87) and of sufficient intensity and duration to expend approximately 300 kilocalories (Kcal) per exercise session are suggested as a threshold level for total body mass and FW loss (12,29,62,67). An expenditure of 200 Kcal per session has also been shown to be useful in weight reduction if the exercise frequency is at least 4 days per week (80). Programs with less participation generally show little or no change in body composition (19,25,42,62,67,84,85,87). Significant increases in Vo_2 max have been shown with 10 to 15 minutes of high intensity training (34,49,56,62,77,78), thus, if total body mass and FW reduction is not a consideration, then short duration, high intensity programs may be recommended for healthy, low risk (cardiovascular disease) persons.
4. The minimal threshold level for improvement in Vo_2 max is approximately 60% of the maximum heart rate reserve (50% of Vo_2 max) (33,37). Maximum heart rate reserve represents the percent difference between resting and maximum heart rate, added to the resting heart rate. The technique as described by Karvonen, Kentala, and Mustala (37), was validated by Davis and Convertino (14), and represents a heart rate of approximately 130 to 135 beats/minute for young persons. As a result of the aging curve for maximum heart rate, the absolute heart rate value (threshold level) is inversely related to age, and can be as low as 110 to 120 beats/minute for older persons. Initial level of fitness is another important consideration in prescribing exercise (10, 40,46,75,77). The person with a low fitness level can get a significant training effect with a sustained training heart rate as low as 110 to 120 beats/minute, while persons of higher fitness levels need a higher threshold of stimulation (26).
5. Intensity and duration of training are interrelated with the total amount of work accomplished being an important factor in improvement in fitness (2,7,12,40,61,62,76,78). Although more comprehensive inquiry is necessary, present evidence suggests that when exercise is performed above the minimal threshold of intensity, the total amount of work accomplished is the important factor in fitness development (2,7,12,61,62,76,79) and maintenance (68). That is, improvement will be similar for activities performed at a lower intensity-longer duration compared to higher intensity-shorter duration if the total energy cost of the activities are equal.

If frequency, intensity, and duration of training are similar (total Kcal expenditure), the training result appears to be independent of the mode of aerobic activity (56,60,62,64). Therefore, a variety of endurance activities, e.g. listed above, may be used to derive the same training effect.

vii

- Con el trabajo de muchos investigadores: Karvonen, Pollock
- Pronunciamiento sobre la cantidad y calidad de ejercicio para desarrollar y mantener la condición física en adultos sanos

ACSM - 1978

American College of Sports Medicine

Position Statement on

The Recommended Quantity and Quality Of Exercise for Developing and Maintaining Fitness in Healthy Adults

Increasing numbers of persons are becoming involved in endurance training activities and thus, the need for guidelines for exercise prescription is apparent.

Based on the existing evidence concerning exercise prescription for healthy adults and the need for guidelines, the American College of Sports Medicine makes the following recommendations for the quantity and quality of training for developing and maintaining cardiorespiratory fitness and body composition in the healthy adult:

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vii

- Frecuencia: 3-5 días / sem
- Intensidad: 60-90% FCR ó 50-85% VO_2max
- Duración: 15-60 minutos actividad continua
- Modo: Cualquier actividad que involucre grandes grupos musculares y es ritmica y aeróbica

ACSM - 1978

In summary, frequency, intensity and duration of training have been found to be effective stimuli for producing a training effect. In general, the lower the stimuli, the lower the training effect (2,12,13,27,35,46,77,78,90), and the greater the stimuli, the greater the effect (2,12,13,27,58,77,78). It has also been shown that endurance training less than two days per week, less than 50% of maximum oxygen uptake, and less than 10 minutes per day is inadequate for developing and maintaining fitness for healthy adults.

ACSM - 1978

- Primeras recomendaciones claras.
- Se interpretaron como pautas para la promoción de la salud en general.
- Fundaron la creencia de pensar que el ejercicio que no alcanzaba esa recomendación sería de valor limitado o nulo.
- Varias recomendaciones de ejercicio posteriores.
  - President’s Council on Physical Fitness (1965)
  - YMCA (1989).
  - The AHA (1972, 1975, 1992, 1993, 1994, 1995).

THE LANCET ORIGINAL ARTICLES [SEPT. 25, 1953

CORONARY HEART-DISEASE AND PHYSICAL ACTIVITY OF WORK

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AT THE HOSPITAL DEPARTMENT, LONDON TRANSPORT EXECUTIVE

C. G. ROBERTS M.B., B.S., M.D. Camb.
J. W. PARRY M.B.E., M.D. Camb., D.C.H.
OF THE TRANSPORT MEDICAL SERVICE

Two questions are considered in the epidemiology of coronary thrombosis: Study of mortality from heart-disease [1] suggests that there has been a true increase of it, and that this is not due simply to an increase of coronary sclerosis. The sclerosis, it seems, is the basic condition in the production of the disease; thrombosis, coronary and its origins of atheroma, thrombosis, and the rapidity of the heart to deal with these in relation to the physical work upon it, all need to be studied.

Mortality rates are made from the Social Medicine Research Unit's records of deaths from coronary heart-disease as a problem in public health, and in the hope of uncovering social factors which may be favourable or unfavourable to the development of the disease. A series of medical practitioners [2] indicated that such epidemiological study can be carried out with relatively small numbers, and that it may be rewarding. The present report extends this study to other workers and describes the first results. The methods are described in the previous papers where the possibilities and limitations of this type of investigation are considered, and points of theory and method are discussed in some detail.

I. CORONARY HEART-DISEASE IN DIFFERENT OCCUPATIONS

London Transport

The occurrence of coronary heart-disease in certain groups of weekly paid employees of London Transport has been studied. The groups are those with a regular assignment between the unit and the Chief Medical Officer and Staff Administration Officer of London Transport. The groups are the conductors and the motormen of the Central (" red ") buses, the drivers and conductors of the trams and trolley-buses, and the motormen and guards on the Underground railways, who thereof. About 31,000 men, aged 35 to 64, were included. The numbers of deaths from coronary heart-disease in each grade were large and the groups were homogeneous as regards occupation.

Investigations of this type have two sets of facts are required.

1) Facts about all the episodes of coronary heart-disease that were recognized during the period under review, and about the working conditions.

2) Facts about the " populations " to which those workers belong.

This information was obtained in the manner described below.

As part of the general study of industrial morbidity being made by the Social Medicine Research Unit, particulars thereof of any diseases for those 31,000 employees are handed to a Central Record of Staff Statistics maintained by the Transport Medical Service. Records of sickness are received from general practitioners and hospital certificates, but from the London Transport medical officers who examine all men who return to work after absence for more than seven days. In addition, cases of heart-disease with absences of any duration are re-examined. All diagnoses are coded by the international three-figure code.* Details of all deaths and of all retirements due to ill health are also recorded by the Central Record of Staff Statistics. For the years 1949–50 death certificates were available, as were the diagnoses of the London Transport medical officers for ill-health retirements, and these were compared with the data in the Central Record of Staff Statistics to ensure accuracy of data.

By special arrangement for the present inquiry, all absences, for any cause, amounting to a total of 28 days in the year 1949 assigned to any code number from 420 to 434 (inclusive) were reported to the medical department for detailed scrutiny; and all cases of angina pectoris, coronary thrombosis, coronary sclerosis, and doubtful cases for consideration, were then " notified " to the unit. (It is, of course, to be appreciated that the absence, whether recurring or of duty, were included.)

From the Central Record of Staff Statistics population figures for the groups under review in the years under review were available at the beginning and end of each year the investigation covered.

RESULTS

Incidence and Early Mortality

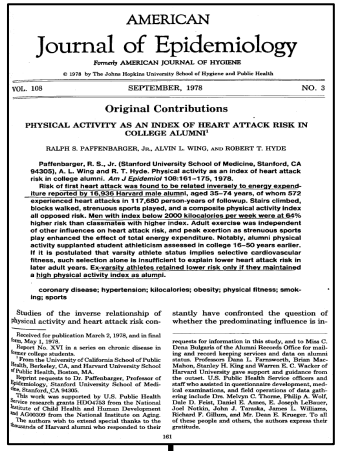
TABLE I.—INCIDENCE OF AND MORTALITY BECAUSE OF CORONARY HEART-DISEASE; AND INFORMATION FROM INDUSTRIAL SOURCES ON MEN OF DIFFERENT AGES IN VARIOUS PAID STAFF [MEN AGED 35–64 (INCLUSIVE) OF LONDON TRANSPORT EXECUTIVE, 1949–50

Ages (years)	(1) Angina pectoris	(2) Coronary thrombosis not fatal	(3) Coronary thrombosis fatal	Total fatal plus non-fatal
	No. of men	Rate per 1,000 p.a.	No. of men	Rate per 1,000 p.a.	No. of men	Rate per 1,000 p.a.	No. of men	Rate per 1,000 p.a.
35–39	9	...	2	...	0	...	2	...
40–44	1	...	5	0·2	0	...	5	0·2
45–49	1	...	10	1·1	6	0·6	16	1·8
50–54	5	0·5	14	1·4	8	0·8	22	2·2
55–59	11	1·6	15	1·8	8	1·0	23	2·8
60–64	8	1·5	10	1·1	5	0·5	15	1·6
Total no. of cases	35		56		34		113	
Occupational rate per 1,000 p.a.		0·4		0·5		0·3		1·2

First clinical episode—clinical onset of disease = the first recognized date of angina pectoris, coronary thrombosis, or sudden death. This was taken to be the same as the first absence from work for any of these conditions. Only the first episode in each man was considered, and all deaths are known. The experience of each man is reckoned from the beginning of the year in which he took coronary-disease sickness, and it ceases at death, retirement, or the end of the year 1949. Men who died or retired in 1950 are included.

Rates.—The rates are standardized for age to permit comparison of the experience of the various groups of workers. The basis is the total number of men in the groups, aged 35–64, in 1949–50.

* Abridged from Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death, Second Revised Edition, 1948 (World Health Organization, Geneva).



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Original Contributions

PHYSICAL ACTIVITY AS AN INDEX OF HEART ATTACK RISK IN COLLEGE ALUMNI[1]

RALPH S. PAFFENBARGER, Jr., ALVIN L. WING, and ROBERT T. HYDE

Paffenbarger, R. S., Jr. (Stanford University School of Medicine, Stanford, CA 94305), A. L. Wing and R. T. Hyde. Physical activity as an index of heart attack risk in college alumni. *Am J Epidemiol* **108:161–175, 1978.**

Risk of first heart attack was found to be related inversely to energy expenditure reported by 16,936 Harvard male alumni, aged 35–74 years, of whom 572 experienced heart attacks in 117,680 person-years of followup. Stairs climbed, blocks walked, strenuous sports played, and a composite physical activity index all opposed risk. Men with index below 2000 kilocalories per week were at 64% higher risk than classmates with higher index. Adult exercise was independent of other influences on heart attack risk, and peak exertion as strenuous sports play enhanced the effect of total energy expenditure. Notably, alumni physical activity supplanted student athleticism assessed in college 16–50 years earlier. If it is postulated that varsity athlete status implies selective cardiovascular fitness, such selection alone is insufficient to explain lower heart attack risk in later adult years. Ex-varsity athletes retained lower risk only if they maintained a high physical activity index as adults.

coronary disease; hypertension; kilocalories; obesity; physical fitness; smoking; sports

Studies of the inverse relationship of physical activity and heart attack risk among college students [1–3], the University of California School of Public Health, Berkeley, CA, and Harvard University School of Public Health, Boston, MA.

Reprint requests to Dr. Paffenbarger, Professor of Epidemiology, Stanford University School of Medicine, Stanford, CA 94305.

This work was supported by U.S. Public Health Service research grants HD04768 from the National Institute of Child Health and Human Development and HL18975 from the National Heart and Lung Institute.

The authors wish to extend thanks to the thousands of Harvard alumni who responded to their requests for information in this study, and to Miss C. Dena Bolgiels of the Alumni Records Office for mailing and record keeping services and data on alumni deaths; to Dr. Jeremiah Morris, Dr. Jerry Morris, Dr. Ralph Mobus, Stanley H. King and Warren H. O. Wacker of Harvard University gave support and guidance from the outset. U.S. Public Health Service officers and staff who assisted in questionnaire development, medical examinations, and field operations of data gathering include Drs. Melvyn C. Thorne, Philip A. Wolf, Dale D. Feist, Daniel F. Ames, E. Joseph LaSmear, Joel Natkin, John J. Taraska, James L. Williams, Thomas J. Gilboe, and Mr. Dean E. Krueger. To all of these people and others, the authors express their gratitude.

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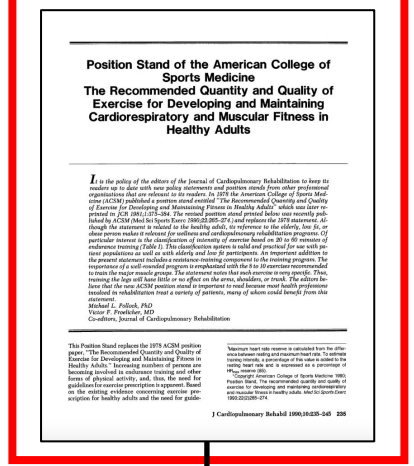
(Paper No. XVI in a series on chronic disease in former college students.)



Position Stand of the American College of Sports Medicine
The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults

It is the policy of the editors of the Journal of Cardiopulmonary Rehabilitation *to keep its readers up to date with new policy statements and position stands from other professional organizations that are relevant to its readers. In 1978 the American College of Sports Medicine (ACSM) published a position stand entitled "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults" which was later reprinted in* JCSM (Med Sci Sports 10(3):vii–x, 1978). *The ACSM position stand printed below contains published material from the original ACSM position stand. The editors suggested to the writing team that although the statement is related to the healthy adult, its reference to the elderly, low fit, or obese person makes it relevant for wellness and cardiopulmonary rehabilitation programs. Of particular interest is the classification of intensity of exercise based on 20 to 60 minutes of endurance training (Table 1). This classification system is valid and practical for use with patient populations as well as with elderly and low fit participants. An important addition to the present statement includes a resistance-training component to the training program. The importance of a well-rounded program is emphasized with the 8 to 10 exercises recommended to train the major muscle groups. The statement notes that much exercise is very specific. Thus, training the legs will have little or no effect on the arms, shoulders, or trunk. The editors believe that the new ACSM position stand is important to read because most health professions involved in rehabilitation treat a variety of patients, many of whom could benefit from this statement.*

Michael L. Pollock, PhD
Victor F. Froelicher, MD
Co-editors, Journal of Cardiopulmonary Rehabilitation

This Position Stand replaces the 1978 ACSM position paper, "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults." Increasing numbers of persons are becoming involved in endurance training and other forms of physical activity, and, thus, the need for guidelines for exercise prescription is apparent. Based on the existing evidence concerning exercise prescription for healthy adults and the need for guidelines, the American College of Sports Medicine has developed recommendations for the quantity and quality of training for developing and maintaining cardiorespiratory fitness and body composition in the healthy adult.

Telemann heart rate reserve is calculated from the difference between resting and maximum heart rate. To estimate the oxygen uptake reserve, the value obtained is then added to the resting heart rate and is expressed as a percentage of HR_{max} reserve (80).

(Reprinted from American College of Sports Medicine: 1990. Position Stand. The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness in healthy adults. Med Sci Sports Exerc 1990;22(2):265–274.

J Cardiopulmonary Rehabil 1990;10:235–245 235

1953 1970 1978 1990 1992

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WORK ACTIVITY OF LONGSHOREMEN AS RELATED TO DEATH FROM CORONARY HEART DISEASE AND STROKE*

RALPH S. PAFFENBARGER, Jr., M.D., MARY ELIZABETH LAUGHLIN, M.S., ALFRED S. GIMA, M.D., AND REBECCA A. BLACK, B.A.

Abstract In a 16-year follow-up study after multiphasic screening, 791 of 3260 longshoremen died of coronary disease, and 67 of stroke.

Men with more sedentary jobs expended 825 fewer calories per work day and sustained coronary death rates one third higher than those among cargo handlers. Rate differences were largest at youngest ages and decreased steadily thereafter. Yet heavier cigarette smoking and higher systolic blood pressure had stronger influences in coronary mortality than sedentary work activity or heavier weight for height.

Cargo handlers sustained death rates from stroke similar to those of more sedentary longshoremen. Mortality from stroke, however, was three times higher among men with higher levels of systolic blood pressure than among those with lower levels. Physical activity thus may have a more striking influence on myocardial infarction than on atherosclerosis.

IN 1951 a large sample of San Francisco longshoremen underwent multiphasic screening examinations[1,2] that included assessment of many characteristics suspected of affecting the incidence of degenerative arterial disease. We have completed a 16-year mortality follow-up study of these men, and report here on the 3263 who were 35 to 64 years of age and on whom job assignment, cigarette habit, blood-pressure level and weight-for-height pattern were determined at the initial examination. Less than 2 per cent of the original sample of longshoremen meeting these criteria were lost to follow-up observation. A total of 808 deaths, including 201 fatal attacks of coronary heart disease and 67 of stroke, were identified in the 44,568 person years of experience. We present death rates from these diseases in terms of single and combined characteristics measured at the initial examination.

METHODS

The collective experience of longshoremen was examined on two-level scales of each characteristic studied. Handling cargo versus less active jobs divided the men into groups representing 60 and 32 per cent of the population. Smoking less than one package of cigarettes a day or not at all versus smoking one or more packages created groups of 61 and 39 per cent, respectively. Distribution according to five-year age classes more than twice below mean systolic-blood-pressure levels (Table 1) versus those above such levels and screening the totals produced groups of 57 and 43 per cent. Plotting a weight-for-height regression line for each five-year age class (Table 1) divided the longshoremen evenly into the group whose weight for height was below mean level and the group above. The proportions of longshoremen who fell into high-risk levels of each characteristic are given in Table 2.

From official death certificates, we identified 201 coronary (underlying cause 420, International Classification of Diseases, seventh edition) and 67 stroke deaths (35 of cerebrolytic cause 330 or 331, and 32 of cause 332 or 334) occurring during the 16

TABLE 1. *Mean Systolic-Blood-Pressure Levels and Body Weight-for-Height Regression Lines among Longshoremen According to Age at Initial Examination.*

Age (Yr) at 1951	Mean Systolic Blood-Pressure Level	Height Intercept	Mean Weight Slope	Sum of Squares
35–39	120	49.0	101.5	.015
40–44	126	46.8	102.4	.016
45–49	140	46.1	176.6	.019
50–54	146	46.1	178.7	.015
55–59	151	47.2	177.4	.018
60–64	155	47.6	179.4	.040

* $Y = a' + b'(X - \bar{X})$, where Y is height & X weight of study subjects.

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Whole of activity. Any activity that uses large muscle groups, that can be maintained continuously, and is rhythmical and aerobic in nature, e.g. running-jogging, walking-hiking, swimming, skating, bicycling, rowing, cross-country skiing, jump skipping, and various endurance game activities.

Rationale and Research Background

The "dose" (amount and intensity) of exercise and what type of exercise is best for developing and maintaining fitness[1], are frequently asked. It is recognized that the term "physical fitness" is composed of a wide variety of variables included in the broad categories of cardiovascular-respiratory fitness, physique and body composition, and the various components of muscular fitness. It is also recognized that the adaptative response to training is complex and includes peripheral, central, structural, and functional factors. Although many such variables and their adaptation response to training have been documented, the lack of adequate data on dose-response relationships (frequency, intensity, and duration of training) make it difficult to draw accurate comparative models. Thus, in respect to the above questions, there will be limited to discussion in Yes, total body mass, fat weight (FW), and lean body weight (LBW) factors.

Exercise training program is based upon the frequency, intensity, and duration of training, the mode of activity (aerobic in nature, e.g., listed under No. 2 above), and the initial level of fitness. In evaluating these factors, the following observations have been derived from studies conducted with endurance training programs.

1. Improvement in Vo_2 max is directly related to frequency [1,11,12,16,30,60,77,78], intensity [2,10,11,28,33,37,40,76,77], and duration [1,14,28,46, 56,77,86] of training. Depending upon the quantity and quality of training, improvements in Vo_2 max can range from 5% to 25% [4,11,27,31,33,36,37,40,52,53,76,77,86]. Generally, those individuals who are initially less than 25% have been shown, they are usually associated with a low total body mass and FW loss, or a low initial level of fitness. Also, as a result of leg fatigue or a lack of motivation, persons with low initial fitness may have spuriously low initial Vo_2 max values.

3. The amount of improvement in Vo_2 max tends to plateau when frequency of training is increased above 3 days per week [23,66,69]. For the non-athlete, there is not enough information to indicate if 2 days per week is sufficient. Pollock [66] has performed found in programs that are conducted more than 5 days per week. Participation of less than two days per week does not show an adequate change in Vo_2 max [34,36,66].

3. Total body mass and FW are generally reduced with endurance training [4,11,12,16,27,28,31,33,36,37,40,52,53,76,77,86] [42,87,87], or increases slightly [34]. Programs that are conducted at least 3 days per week [16,30,61,66,87], of at least 20 minutes duration [40,62,87] and of sufficient intensity and duration to expend approximately 300 kilocalories (Kcal) per session, 3 times per week [11,12,16,30,60,77,78], will reduce body mass and FW loss [12,30,62,87]. As expenditure of 200 Kcal per session has also been shown to be useful in weight reduction if the exercise frequency is at least 4 days per week [66]. Programs with less participation generally show little or no change in body mass and FW [11,12,16,30,60,77,78]. Also, a loss in Vo_2 max in excess has been shown with 40 to 15 minutes of high intensity training [34,40,62,77,78], thus, if total body mass and FW reduction is not a consideration, then short duration, high intensity programs may be recommended for healthy, low fit individuals or cardiac patients.

4. The minimal threshold level for improvement in Vo_2 max is approximately 60% of the maximum heart rate reserve (50% of Vo_2 max) [33,37]. Maximum heart rate reserve represents the percent difference between resting and maximum heart rate. This is defined as the resting heart rate plus a percentage of the increment of a wide variety of variables included in the broad categories of cardiovascular-respiratory fitness, physique and body composition, and the various components of muscular fitness. It is also recognized that the adaptative response to training is complex and includes peripheral, central, structural, and functional factors. Although many such variables and their adaptation response to training have been documented, the lack of adequate data on dose-response relationships (frequency, intensity, and duration of training make it difficult to draw accurate comparative models. Thus, in respect to the above questions, there will be limited to discussion in Yes, total body mass, fat weight (FW), and lean body weight (LBW) factors.

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AHA Medical/Scientific Statement

Position Statement

Statement on Exercise

Benefits and Recommendations for Physical Activity Programs for All Americans

A Statement for Health Professionals by the Committee on Exercise and Cardiac Rehabilitation of the Council on Clinical Cardiology, American Heart Association

Gerald F. Fletcher, MD, Chairman; Steven N. Blair, PhD; James Blumenthal, PhD; Carl Caspersen, PhD; Bernard Chaitman, MD; Stephen Epstein, MD; Harold Falls, PhD; Erika S. Sivarajan Froelicher, PhD, MPH, RN; Victor F. Froelicher, MD; and Ileana L. Pina, MD, Members

Regular aerobic physical activity increases exercise capacity and plays a role in both primary and secondary prevention of cardiovascular disease.[1-3] The known benefits of regular aerobic exercise and recommendations for implementation of exercise programs for healthy adults and for cardiac patients are reorganized as a risk factor for coronary artery disease.

Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in apparently healthy persons as well as in most patients with cardiovascular disease. Regular physical activity is required to maintain these beneficial effects. The potential risk of physical activity can be reduced by medical evaluation, supervision, and education.

Exercise can help control elevated lipid and carbohydrate metabolism. The exercise-induced increase in high density lipoproteins is strongly associated with changes in body weight.[4] In addition, regular exercise in overweight women and men enhances the beneficial effects of a low-saturated fat and low-cholesterol diet.[5]

Developing endurance, joint flexibility, and muscle strength is important in a comprehensive exercise program, especially as people age. However, static or isometric exercise has not been shown to lower coronary risk. Patients with cardiovascular disease usually asked to refrain from heavy lifting and forceful isometric exercises, although the use of light weights seems beneficial in developing muscle strength and joint flexibility. Careful isometric training alone or with aerobic training is generally safe and effective in patients with cardiovascular disease who are medically stable and are in a supervised program.[6-10]

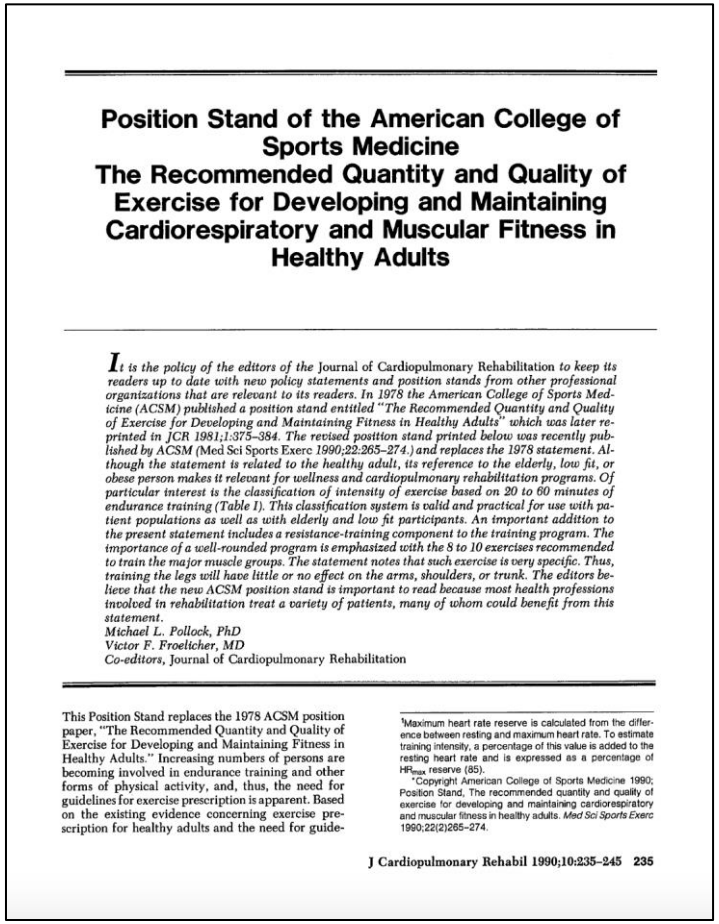
Many activities of daily living require arm work more than leg work. Therefore, patients with coronary artery disease are advised to use their arms as well as their legs in exercise training. The arms respond like the legs to exercise training both quantitatively and qualitatively,

"Statement on Exercise" was approved by the American Heart Association Steering Committee on February 10, 1962.

Requests for reprints should be sent to the Office of Scientific Affairs, American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231-4596.

ACSM - 1990

- Se añade el desarrollo de la fuerza muscular como un objetivo importante.
- Frecuencia, intensidad, y modo de ejercicio se mantuvieron
- La duración aumentó de 15-60 minutos a 20-60
- Se reconoció que las actividades de intensidad moderada podían tener beneficios para la salud independientes del nivel de fitness cardiorespiratorio.



Position Stand of the American College of Sports Medicine
The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults

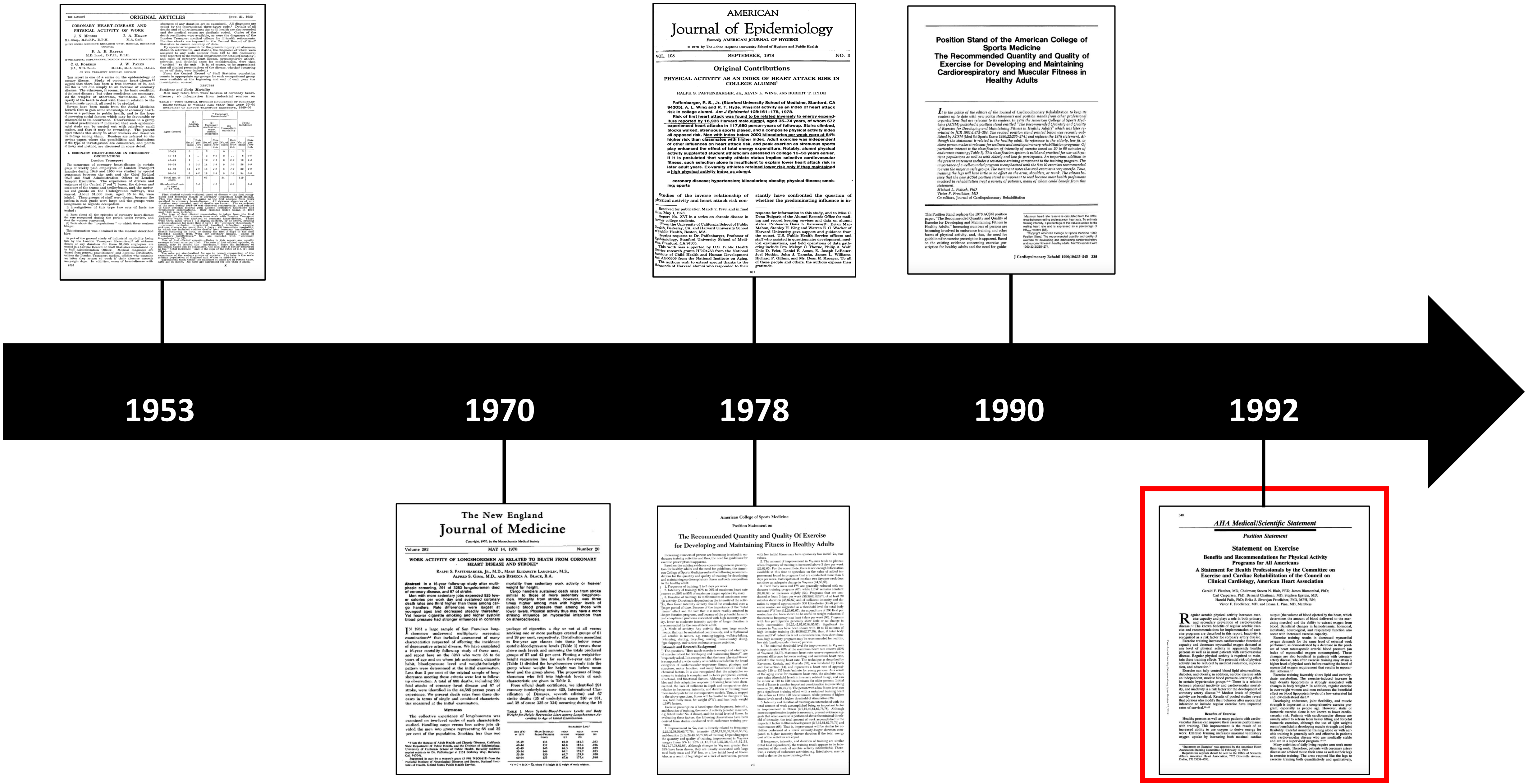
It is the policy of the editors of the Journal of Cardiopulmonary Rehabilitation *to keep its readers up to date with new policy statements and position stands from other professional organizations that are relevant to its readers. In 1978 the American College of Sports Medicine (ACSM) published a position stand entitled "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults" which was later reprinted in JCR 1981;1:375–384. The revised posttion stand printed below was recently published by ACSM* (Med Sci Sports Exerc *1990;22:265–274.) and replaces the 1978 statement. Although the statement is related to the healthy adult, its reference to the elderly, low fit, or obese person makes it relevant for wellness and cardiopulmonary rehabilitation programs. Of particular interest is the classification of intensity of exercise based on 20 to 60 minutes of endurance training (Table 1). This classification system is valid and practical for use with patient populations as well as with elderly and low fit participants. An important addition to the present statement includes a resistance-training component to the training program. The importance of a well-rounded program is emphasized with the 8 to 10 exercises recommended to train the major muscle groups. The statement notes that such exercise is very specific. Thus, training the legs will have little or no effect on the arms, shoulders, or trunk. The editors believe that the new ACSM position stand is important to read because most health professions involved in rehabilitation treat a variety of patients, many of whom could benefit from this statement.*

Michael L. Pollock, PhD
Victor F. Froelicher, MD
Co-editors, Journal of Cardiopulmonary Rehabilitation

This Position Stand replaces the 1978 ACSM position paper, "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults." Increasing numbers of persons are becoming involved in endurance training and other forms of physical activity, and, thus, the need for guidelines for exercise prescription is apparent. Based on the existing evidence concerning exercise prescription for healthy adults and the need for guide-

[1]Maximum heart rate reserve is calculated from the difference between resting and maximum heart rate. To estimate training intensity, a percentage of this value is added to the resting heart rate and is expressed as a percentage of HR_{max} reserve (85).

Position Stand, The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness in healthy adults. *Med Sci Sports Exerc* 1990;22(2)265–274.


1953
1970
1978
1990
1992
ORIGINAL ARTICLES
CORONARY HEART-DISEASE AND PHYSICAL ACTIVITY OF WORK
The New England Journal of Medicine
WORK ACTIVITY OF LONGSHOREMEN AS RELATED TO DEATH FROM CORONARY HEART DISEASE AND STROKE
AMERICAN Journal of Epidemiology
Original Contributions
PHYSICAL ACTIVITY AS AN INDEX OF HEART ATTACK RISK IN COLLEGE ALUMNI
American College of Sports Medicine
Position Statement on
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AHA - 1992

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Position Statement

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Gerald F. Fletcher, MD, Chairman; Steven N. Blair, PED; James Blumenthal, PhD; Carl Caspersen, PhD; Bernard Chaitman, MD; Stephen Epstein, MD; Harold Falls, PhD; Erika S. Sivarajan Froelicher, PhD, MPH, RN; Victor F. Froelicher, MD; and Ileana L. Pina, MD, Members

Regular aerobic physical activity increases exercise capacity and plays a role in both primary and secondary prevention of cardiovascular disease.[1,2] The known benefits of regular aerobic exercise and recommendations for implementation of exercise programs are described in this report. Inactivity is recognized as a risk factor for coronary artery disease.

Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in apparently healthy persons as well as in most patients with cardiovascular disease. Regular physical activity is required to maintain these training effects. The potential risk of physical activity can be reduced by medical evaluation, supervision, and education.[3]

Exercise can help control blood lipid abnormalities, diabetes, and obesity; in addition, aerobic exercise adds an independent, modest blood pressure–lowering effect in certain hypertensive groups.[4–6] There is a relation between physical inactivity and cardiovascular mortality, and inactivity is a risk factor for the development of coronary artery disease.[7–9] Modest levels of physical activity are beneficial. Results of pooled studies reveal that persons who modify their behavior after myocardial infarction to include regular exercise have improved rates of survival.[10–12]

Benefits of Exercise

Healthy persons as well as many patients with cardiovascular disease can improve their exercise performance with training. This improvement is the result of an increased ability to use oxygen to derive energy for work. Exercise training increases maximal ventilatory oxygen uptake by increasing both maximal cardiac output (the volume of blood ejected by the heart, which determines the amount of blood delivered to the exercising muscles) and the ability to extract oxygen from blood. Beneficial changes in hemodynamic, hormonal, metabolic, neurological, and respiratory function also occur with increased exercise capacity.

Exercise training results in decreased myocardial oxygen demands for the same level of external work performed, as demonstrated by a decrease in the product of heart rate×systolic arterial blood pressure (an index of myocardial oxygen consumption). These changes are also beneficial in patients with coronary artery disease, who after exercise training may attain a higher level of physical work before reaching the level of myocardial oxygen requirement that results in myocardial ischemia.[13]

Exercise training favorably alters lipid and carbohydrate metabolism. The exercise-induced increase in high density lipoproteins is strongly associated with changes in body weight.[14] In addition, regular exercise in overweight women and men enhances the beneficial effect on blood lipoprotein levels of a low–saturated fat and low-cholesterol diet.[15]

Developing endurance, joint flexibility, and muscle strength is important in a comprehensive exercise program, especially as people age. However, static or isometric exercise alone is not known to lower cardiovascular risk. Patients with cardiovascular disease are usually asked to refrain from heavy lifting and forceful isometric exercises, although the use of light weights seems beneficial in developing muscle strength and joint flexibility. Careful isometric training alone or with aerobic training is generally safe and effective in patients with cardiovascular disease who are medically stable and are in a supervised program.[16–19]

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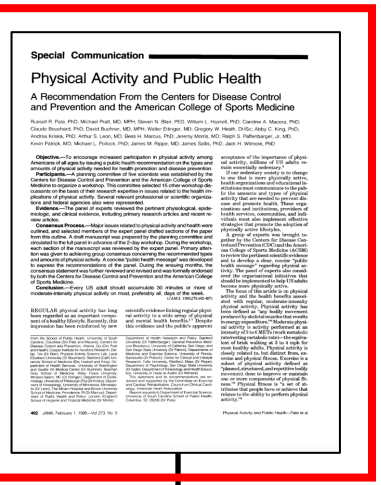
- Se identifica la inactividad física como factor de riesgo para ECV, junto con el tabaquismo, la HTA e hipercolesterolemia.
- Incluso modestos niveles de actividad física son beneficiosos.

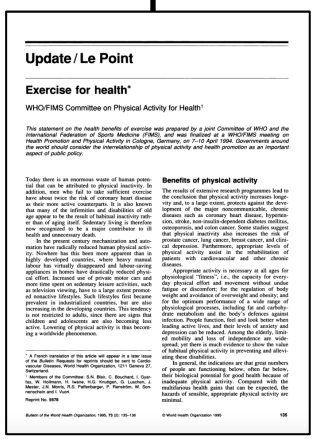


Special Communication

Physical Activity and Public Health

A Recommendation From the Centers for Disease Control and Prevention and the American College of Sports Medicine

1995

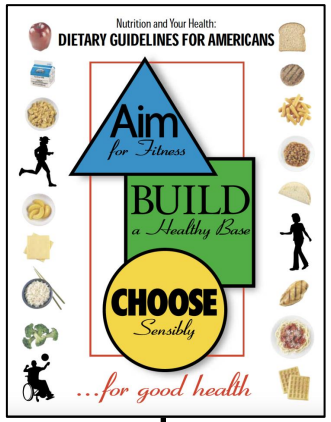


Update / Le Point

Exercise for health*

WHO/FIMS Committee on Physical Activity for Health†

1996



Nutrition and Your Health:
DIETARY GUIDELINES FOR AMERICANS

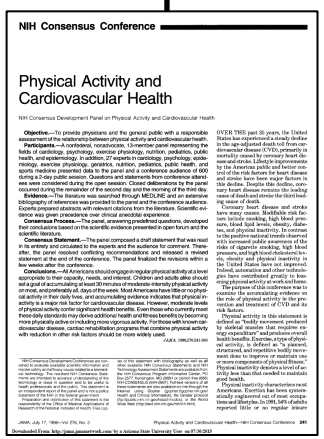
Aim for Fitness

BUILD a Healthy Base

CHOOSE Sensibly

...for good health

2000

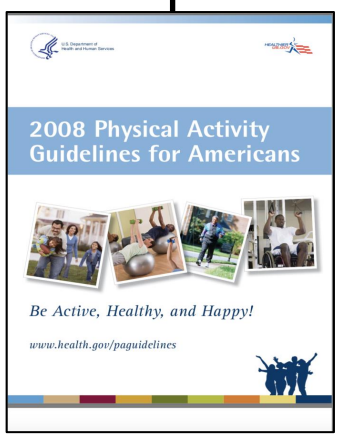


NIH Consensus Conference

Physical Activity and Cardiovascular Health

NIH Consensus Development Panel on Physical Activity and Cardiovascular Health

2008

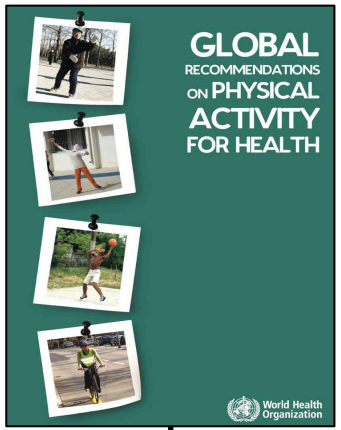


2008 Physical Activity Guidelines for Americans

Be Active, Healthy, and Happy!

www.health.gov/paguidelines

2010



GLOBAL RECOMMENDATIONS ON PHYSICAL ACTIVITY FOR HEALTH

World Health Organization

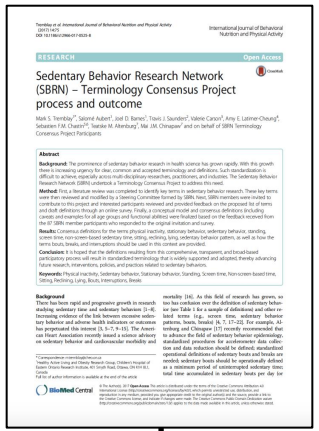
2012

DISCUSSION / DISCUSSION

Letter to the Editor: Standardized use of the terms "sedentary" and "sedentary behaviours"

Sedentary Behaviour Research Network

2017



RESEARCH

Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome

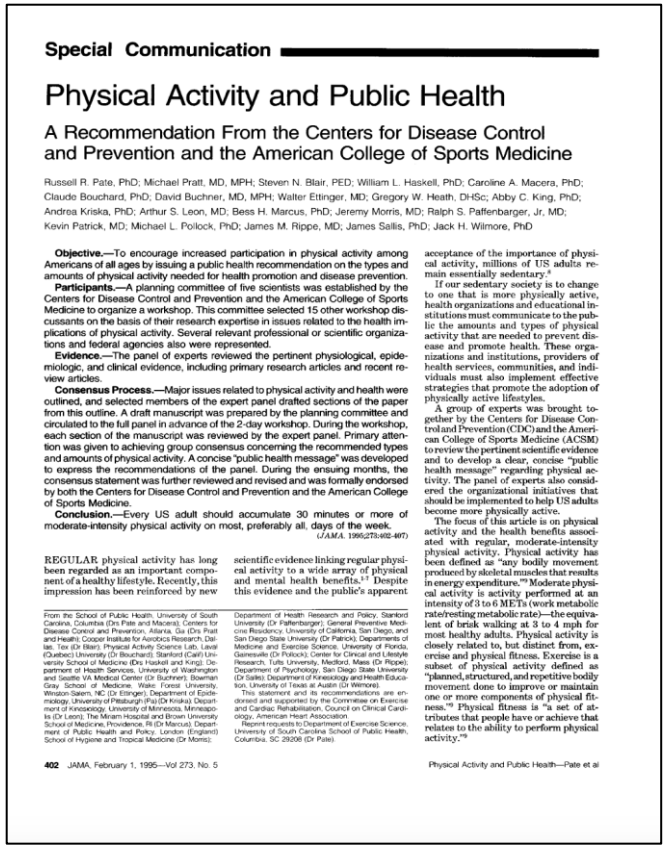
2018

2018 Physical Activity Guidelines Advisory Committee Scientific Report

To the Secretary of Health and Human Services

CDC / ACSM - 1995

- Previas en cantidad y calidad de ejercicio para mejorar la condición física.
- Primeras en actividad física.
- Objetivo: Fomentar una mayor participación en actividad física entre Americanos de todas las edades al emitir una recomendación de salud pública sobre el tipo y cantidad de actividad física necesaria para la promoción de la salud y la prevención de enfermedades.



Special Communication

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Objective.—To encourage increased participation in physical activity among Americans of all ages by issuing a public health recommendation on the types and amounts of physical activity needed for health promotion and disease prevention.

Participants.—A planning committee of five scientists was established by the Centers for Disease Control and Prevention and the American College of Sports Medicine to organize a workshop. This committee selected 15 other workshop discussants on the basis of their research expertise in issues related to the health implications of physical activity. Several relevant professional or scientific organizations and federal agencies also were represented.

Evidence.—The panel of experts reviewed the pertinent physiological, epidemiologic, and clinical evidence, including primary research articles and recent review articles.

Consensus Process.—Major issues related to physical activity and health were outlined, and selected members of the expert panel drafted sections of the paper from this outline. A draft manuscript was prepared by the planning committee and circulated to the full panel in advance of the 2-day workshop. During the workshop, each section of the manuscript was reviewed by the expert panel. Primary attention was given to achieving group consensus concerning the recommended types and amounts of physical activity. A concise "public health message" was developed to express the recommendations of the panel. During the ensuing months, the consensus statement was further reviewed and revised and was formally endorsed by both the Centers for Disease Control and Prevention and the American College of Sports Medicine.

Conclusion.—Every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week.

(*JAMA*. 1995;273:402-407)

REGULAR physical activity has long been regarded as an important component of a healthy lifestyle. Recently, this impression has been reinforced by new scientific evidence linking regular physical activity to a wide array of physical and mental health benefits.[1-1] Despite this evidence and the public's apparent acceptance of the importance of physical activity, millions of US adults remain essentially sedentary.[2]

If our sedentary society is to change to one that is more physically active, health organizations and educational institutions must communicate to the public the amounts and types of physical activity that are needed to prevent disease and promote health. These organizations and institutions, providers of health services, communities, and individuals must also implement effective strategies that promote the adoption of physically active lifestyles.

A group of experts was brought together by the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) to review the pertinent scientific evidence and to develop a clear, concise "public health message" regarding physical activity. The panel of experts also considered the organizational initiatives that should be implemented to help US adults become more physically active.

The focus of this article is on physical activity and the health benefits associated with regular, moderate-intensity physical activity. Physical activity has been defined as "any bodily movement produced by skeletal muscles that results in energy expenditure."[3] Moderate physical activity is activity performed at an intensity of 3 to 6 METs (work metabolic rate/resting metabolic rate)—the equivalent of brisk walking at 3 to 4 mph for most healthy adults. Physical activity is closely related to, but distinct from, exercise and physical fitness. Exercise is a subset of physical activity defined as "planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness."[3] Physical fitness is "a set of attributes that people have or achieve that relates to the ability to perform physical activity."[3]

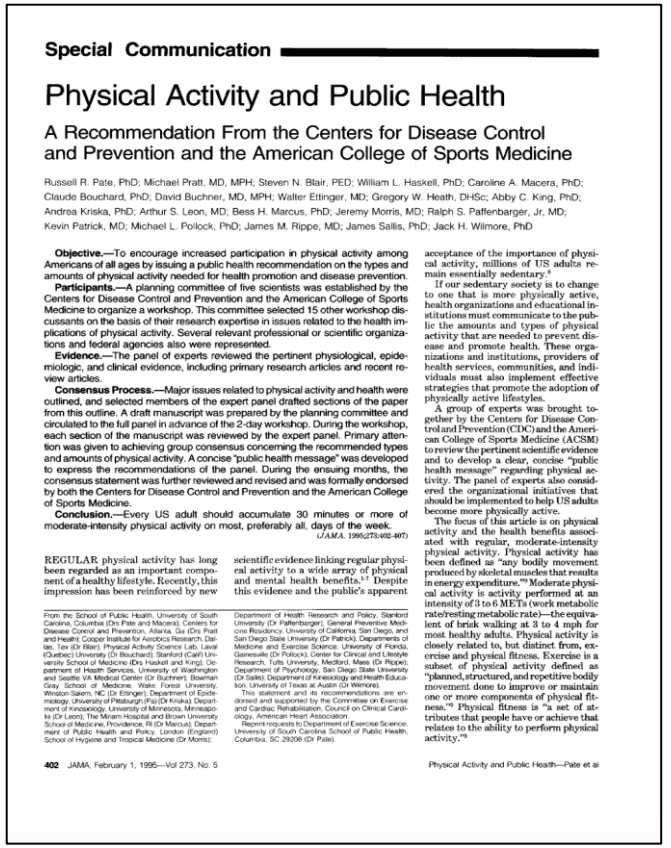
From the School of Public Health, University of South Carolina, Columbia (Drs Pate and Macera); Centers for Disease Control and Prevention, Atlanta, Ga (Drs Pratt and Heath); Cooper Institute for Aerobics Research, Dallas, Tex (Dr Blair); Physical Activity Sciences Lab, Laval (Quebec) University (Dr Bouchard); Stanford (Calif) University School of Medicine (Drs Haskell and King); Department of Health Services, University of Washington and Seattle VA Medical Center (Dr Buchner); Bowman Gray School of Medicine, Wake Forest University, Winston-Salem, NC (Dr Ettinger); Department of Epidemiology, University of Pittsburgh (Pa) (Dr Kriska); Department of Kinesiology, University of Minnesota, Minneapolis (Dr Leon); The Miriam Hospital and Brown University School of Medicine, Providence, RI (Dr Marcus); Department of Public Health and Policy, London (England) School of Hygiene and Tropical Medicine (Dr Morris); Department of Health Research and Policy, Stanford University (Dr Paffenbarger); General Preventive Medicine Residency, University of California, San Diego, and San Diego State University (Dr Patrick); Departments of Medicine and Exercise Science, University of Florida, Gainesville (Dr Pollock); Center for Clinical and Lifestyle Research, Tufts University, Medford, Mass (Dr Rippe); Department of Psychology, San Diego State University (Dr Sallis); Department of Kinesiology and Health Education, University of Texas at Austin (Dr Wilmore).

This statement and its recommendations are endorsed and supported by the Committee on Exercise and Cardiac Rehabilitation, Council on Clinical Cardiology, American Heart Association.

Reprint requests to Department of Exercise Science, University of South Carolina School of Public Health, Columbia, SC 29208 (Dr Pate).

CDC / ACSM - 1995

Cada adulto americano debe acumular 30 minutos o más de Actividad física de intensidad moderada en la mayoría, preferiblemente en todos los días de la semana.



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Reprint requests to Department of Exercise Science, University of South Carolina School of Public Health, Columbia, SC 29208 (Dr Pate).

CDC / ACSM - 1995

Los beneficios para la salud obtenidos de del aumento de la actividad física dependen del nivel de actividad inicial.

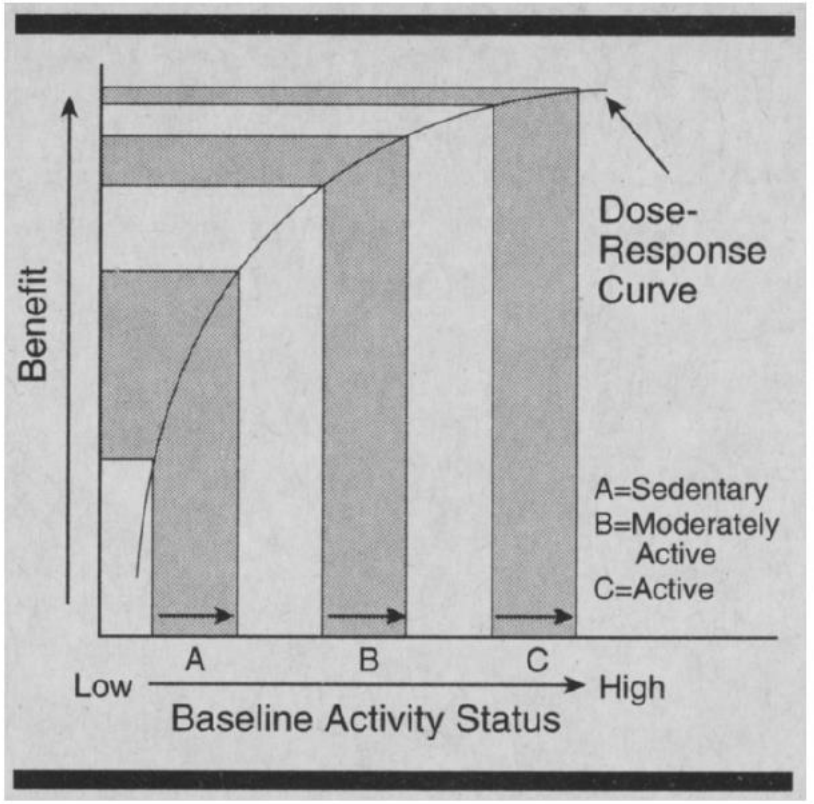
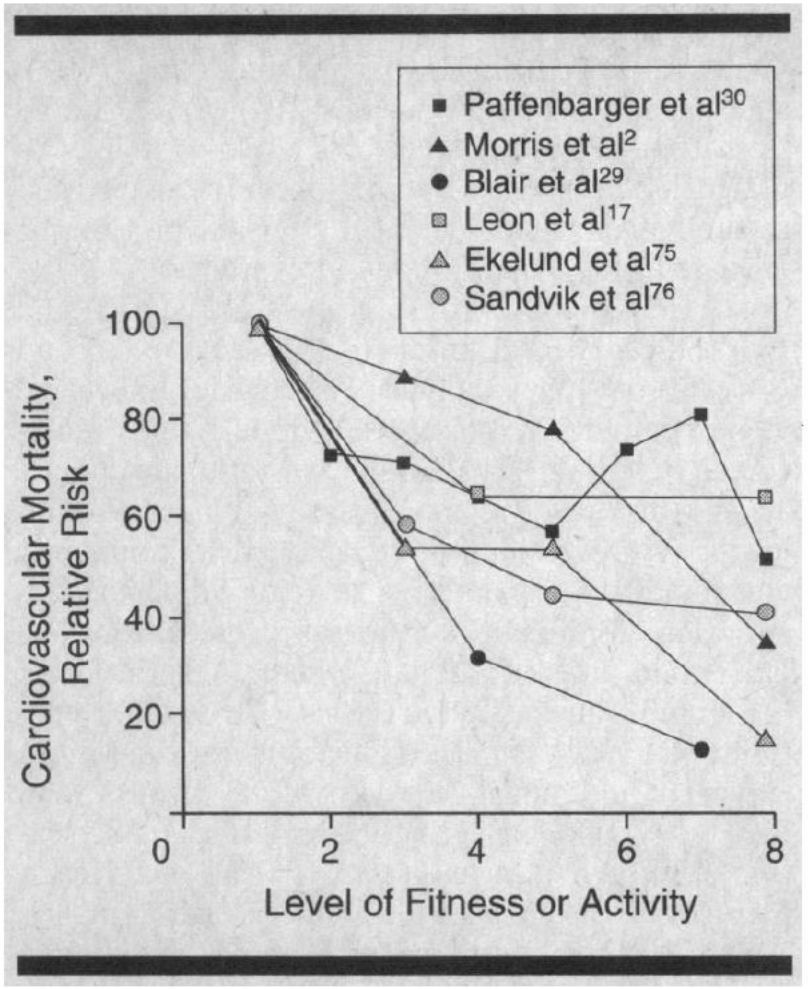


Figure 1.—The dose-response curve represents the best estimate of the relationship between physical activity (dose) and health benefit (response). The lower the baseline physical activity status, the greater will be the health benefit associated with a given increase in physical activity (arrows A, B, and C).

CDC / ACSM - 1995

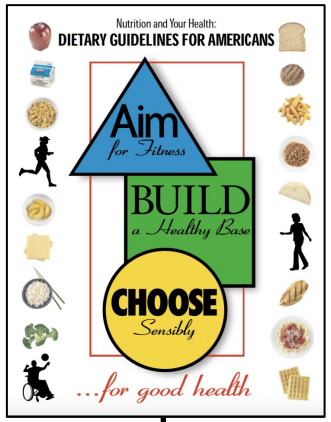
- Se enfatizan los beneficios para la salud de la actividad física de intensidad moderada.
- La acumulación de actividad física en períodos intermitentes (8-10 min), se considera un enfoque apropiado para lograr el objetivo de la actividad.
- Se incrementa la frecuencia de la actividad física que se había planteado para ejercicio.

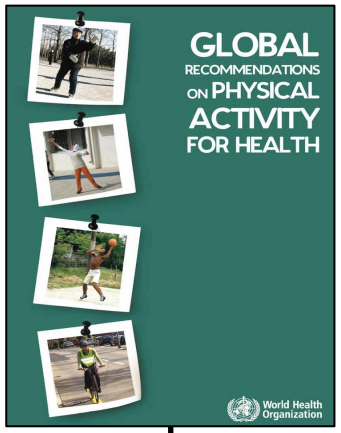


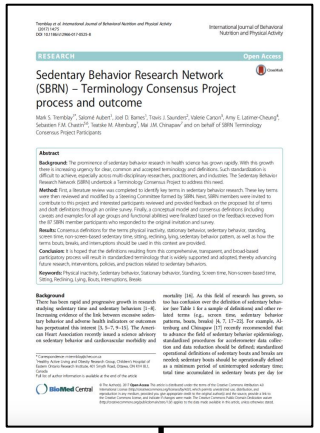
Special Communication

Physical Activity and Public Health

A Recommendation From the Centers for Disease Control and Prevention and the American College of Sports Medicine







Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome

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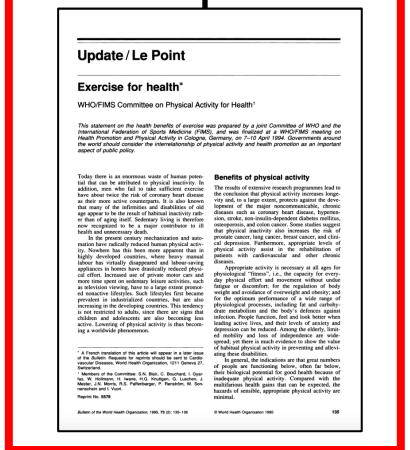

Update / Le Point

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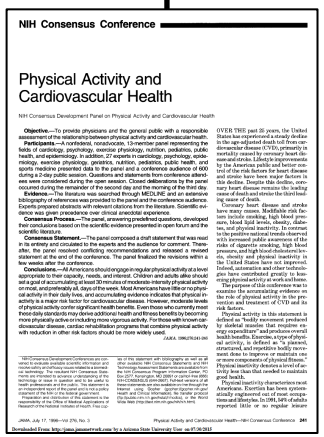

NIH Consensus Conference

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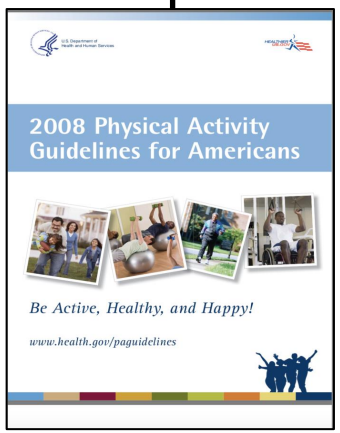

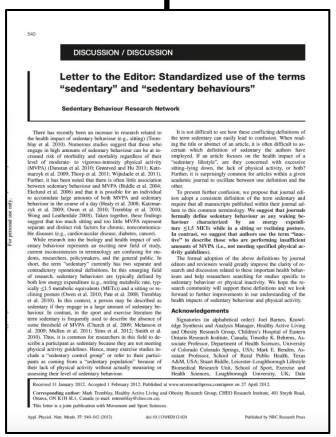

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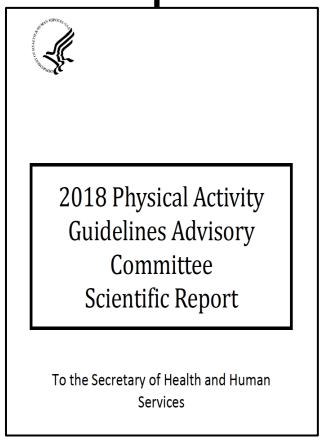
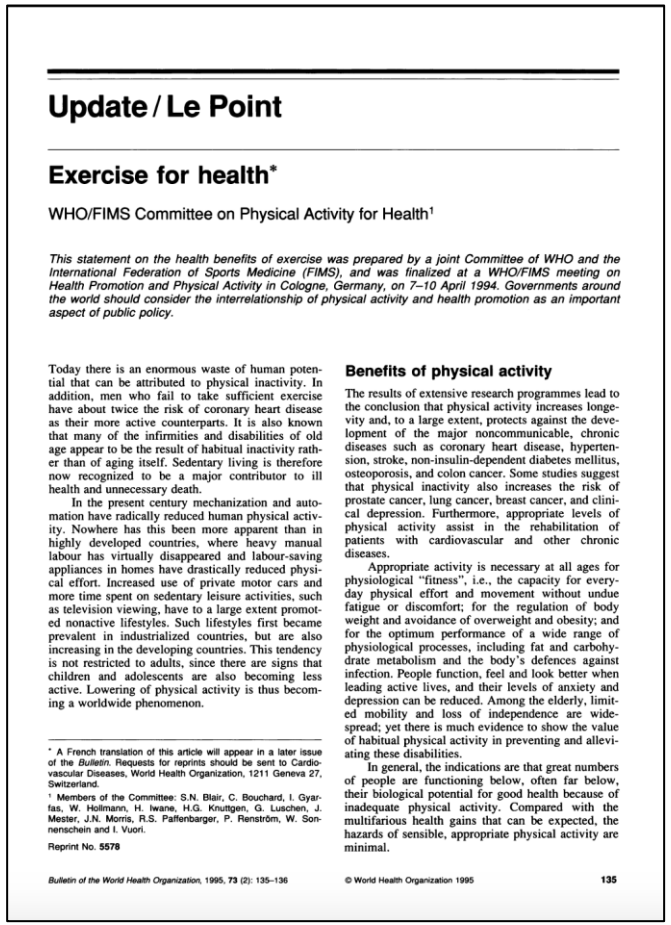


2018 Physical Activity Guidelines Advisory Committee Scientific Report

To the Secretary of Health and Human Services

OMS / FIMS - 1995



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Today there is an enormous waste of human potential that can be attributed to physical inactivity. In addition, men who fail to take sufficient exercise have about twice the risk of coronary heart disease as their more active counterparts. It is also known that many of the infirmities and disabilities of old age appear to be the result of habitual inactivity rather than of aging itself. Sedentary living is therefore now recognized to be a major contributor to ill health and unnecessary death.

In the present century mechanization and automation have radically reduced human physical activity. Nowhere has this been more apparent than in highly developed countries, where heavy manual labour has virtually disappeared and labour-saving appliances in homes have drastically reduced physical effort. Increased use of private motor cars and more time spent on sedentary leisure activities, such as television viewing, have to a large extent promoted nonactive lifestyles. Such lifestyles first became prevalent in industrialized countries, but are also increasing in the developing countries. This tendency is not restricted to adults, since there are signs that children and adolescents are also becoming less active. Lowering of physical activity is thus becoming a worldwide phenomenon.

* A French translation of this article will appear in a later issue of the *Bulletin*. Requests for reprints should be sent to Cardiovascular Diseases, World Health Organization, 1211 Geneva 27, Switzerland.

[1] Members of the Committee: S.N. Blair, C. Bouchard, I. Gyarfas, W. Hollmann, H. Iwane, H.G. Knuttgen, G. Luschen, J. Mester, J.N. Morris, R.S. Paffenbarger, P. Renström, W. Sonnenschein and I. Vuori.

Reprint No. **5578**

Benefits of physical activity

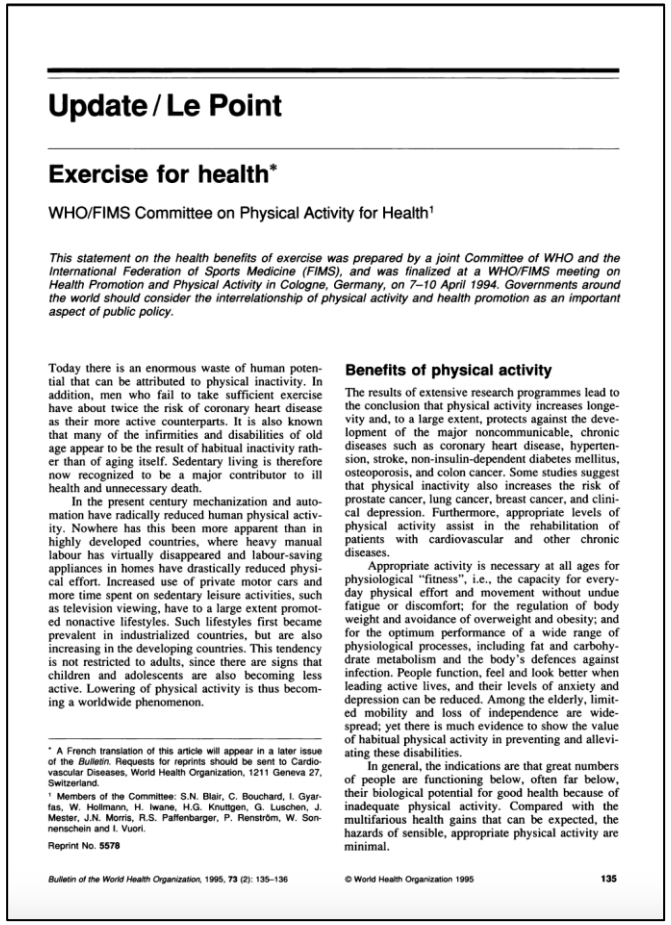
The results of extensive research programmes lead to the conclusion that physical activity increases longevity and, to a large extent, protects against the development of the major noncommunicable, chronic diseases such as coronary heart disease, hypertension, stroke, non-insulin-dependent diabetes mellitus, osteoporosis, and colon cancer. Some studies suggest that physical inactivity also increases the risk of prostate cancer, lung cancer, breast cancer, and clinical depression. Furthermore, appropriate levels of physical activity assist in the rehabilitation of patients with cardiovascular and other chronic diseases.

Appropriate activity is necessary at all ages for physiological "fitness", i.e., the capacity for everyday physical effort and movement without undue fatigue or discomfort; for the regulation of body weight and avoidance of overweight and obesity; and for the optimum performance of a wide range of physiological processes, including fat and carbohydrate metabolism and the body's defences against infection. People function, feel and look better when leading active lives, and their levels of anxiety and depression can be reduced. Among the elderly, limited mobility and loss of independence are widespread; yet there is much evidence to show the value of habitual physical activity in preventing and alleviating these disabilities.

In general, the indications are that great numbers of people are functioning below, often far below, their biological potential for good health because of inadequate physical activity. Compared with the multifarious health gains that can be expected, the hazards of sensible, appropriate physical activity are minimal.

- Ejercicio para la salud (Comité de Actividad Física para la Salud de la OMS / FIMS, 1995IMS 1995)
- La actividad física diaria debe ser aceptada como la piedra angular de un estilo de vida saludable. La actividad física debe reintegrarse en la rutina diaria. Un primer paso obvio sería el uso de escaleras en lugar de ascensores, y caminar o andar en bicicleta en viajes cortos.

OMS / FIMS - 1995



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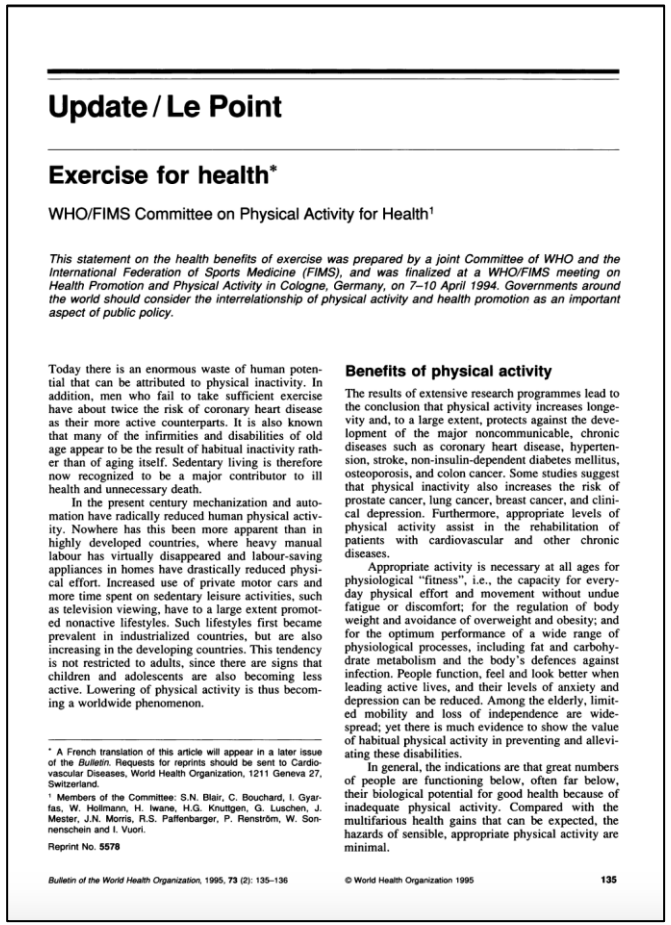
Reprint No. 5578

Bulletin of the World Health Organization, 1995, **73** (2): 135–136

- Para los niños y adolescentes se deben proveer instalaciones y la oportunidad de participar en programas diarios de ejercicio agradable para que la actividad pueda convertirse en un hábito de por vida.
- Se debe alentar a los adultos a aumentar la actividad habitual gradualmente, con el objetivo de realizar todos los días al menos 30 minutos de actividad física de intensidad moderada.

OMS / FIMS - 1995



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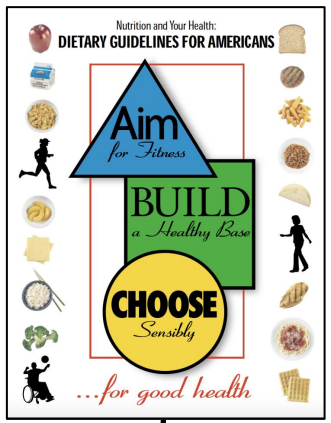
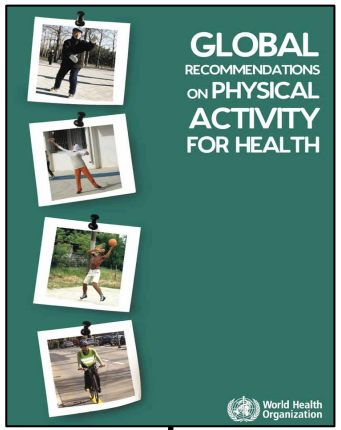
- A las mujeres se les debe ofrecer una variedad de oportunidades y más estímulo para participar en ejercicio saludable.
- Los adultos mayires deberían ser animados a llevar vidas físicamente activas con el fin de mantener su independencia, reducir los riesgos de lesiones corporales, y promover una nutrición óptima.

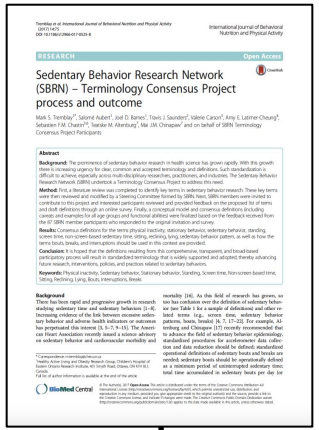
Special Communication

Physical Activity and Public Health

A Recommendation From the Centers for Disease Control and Prevention and the American College of Sports Medicine







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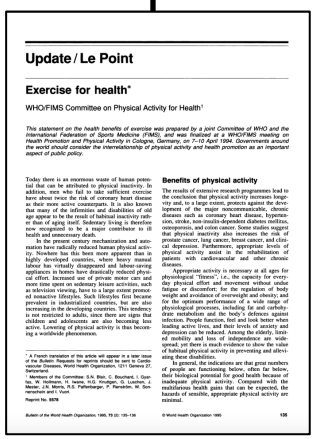

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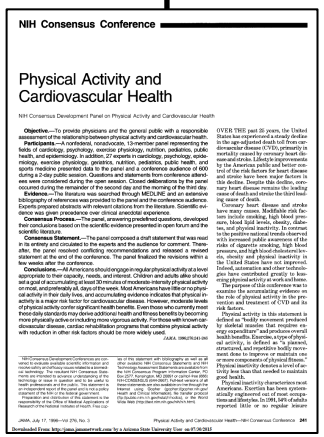

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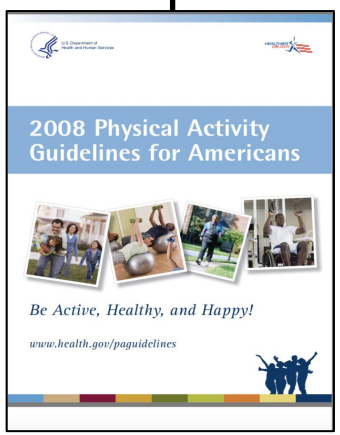

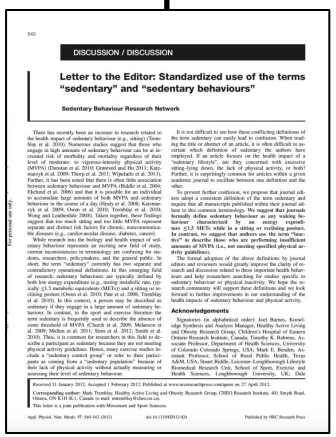

DISCUSSION / DISCUSSION

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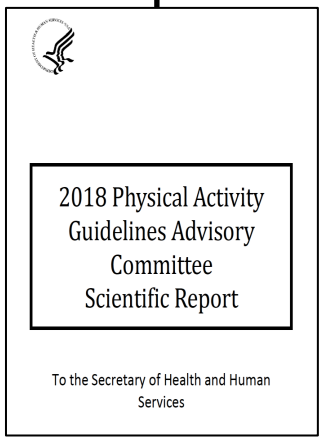
Sedentary Behaviour Research Network



2018 Physical Activity Guidelines Advisory Committee Scientific Report

To the Secretary of Health and Human Services

NIH - 1996

- Todos los Americanos deben realizar actividad física regular a un nivel apropiado a su capacidad, necesidades e intereses.
- Los niños y adultos por igual deben establecer un objetivo de acumular al menos 30 minutos de actividad física de intensidad moderada en la mayoría, y preferiblemente todos, los días de la semana.
- Las personas que ya alcanzan esta recomendación pueden obtener beneficios adicionales para la salud y la condición física al aumentar ya sea la duración o intensidad de la actividad.

NIH Consensus Conference

Physical Activity and Cardiovascular Health

NIH Consensus Development Panel on Physical Activity and Cardiovascular Health

Objective.—To provide physicians and the general public with a responsible assessment of the relationship between physical activity and cardiovascular health.

Participants.—A nonfederal, nonadvocate, 13-member panel representing the fields of cardiology, psychology, exercise physiology, nutrition, pediatrics, public health, and epidemiology. In addition, 27 experts in cardiology, psychology, epidemiology, exercise physiology, geriatrics, nutrition, pediatrics, public health, and sports medicine presented data to the panel and a conference audience of 600 during a 2-day public session. Questions and statements from conference attendees were considered during the open session. Closed deliberations by the panel occurred during the remainder of the second day and the morning of the third day.

Evidence.—The literature was searched through MEDLINE and an extensive bibliography of references was provided to the panel and the conference audience. Experts prepared abstracts with relevant citations from the literature. Scientific evidence was given precedence over clinical anecdotal experience.

Consensus Process.—The panel, answering predefined questions, developed their conclusions based on the scientific evidence presented in open forum and the scientific literature.

Consensus Statement.—The panel composed a draft statement that was read in its entirety and circulated to the experts and the audience for comment. Thereafter, the panel resolved conflicting recommendations and released a revised statement at the end of the conference. The panel finalized the revisions within a few weeks after the conference.

Conclusions.—All Americans should engage in regular physical activity at a level appropriate to their capacity, needs, and interest. Children and adults alike should set a goal of accumulating at least 30 minutes of moderate-intensity physical activity on most, and preferably all, days of the week. Most Americans have little or no physical activity in their daily lives, and accumulating evidence indicates that physical inactivity is a major risk factor for cardiovascular disease. However, moderate levels of physical activity confer significant health benefits. Even those who currently meet these daily standards may derive additional health and fitness benefits by becoming more physically active or including more vigorous activity. For those with known cardiovascular disease, cardiac rehabilitation programs that combine physical activity with reduction in other risk factors should be more widely used.

JAMA. 1996;276:241-246

NIH Consensus Development Conferences are convened to evaluate available scientific information and resolve safety and efficacy issues related to a biomedical technology. The resultant NIH Consensus Statements are intended to advance understanding of the technology or issue in question and to be useful to health professionals and the public. This statement is an independent report of the panel and is not a policy statement of the NIH or the federal government.

Preparation and distribution of this statement is the responsibility of the Office of Medical Applications of Research of the National Institutes of Health. Free copies of this statement with bibliography as well as all other available NIH Consensus Statements and NIH Technology Assessment Statements are available from the NIH Consensus Program Information Center, PO Box 2577, Kensington, MD 20891 or call toll-free (888) NIH-CONSENSUS (644-2667). Full-text versions of all these statements are also available on-line through the Internet using Gopher (gopher://gopher.nih.gov/Health and Clinical Information), file transfer protocol (ftp://public.nlm.nih.gov/htstat/nihodds), or the World Wide Web (http://text.nlm.nih.gov/nih/nih.html).

OVER THE past 25 years, the United States has experienced a steady decline in the age-adjusted death toll from cardiovascular disease (CVD), primarily in mortality caused by coronary heart disease and stroke. Lifestyle improvements by the American public and better control of the risk factors for heart disease and stroke have been major factors in this decline. Despite this decline, coronary heart disease remains the leading cause of death and stroke the third leading cause of death.

Coronary heart disease and stroke have many causes. Modifiable risk factors include smoking, high blood pressure, blood lipid levels, obesity, diabetes, and physical inactivity. In contrast to the positive national trends observed with increased public awareness of the risks of cigarette smoking, high blood pressure, and high blood cholesterol levels, obesity and physical inactivity in the United States have not improved. Indeed, automation and other technologies have contributed greatly to lessening physical activity at work and home.

The purpose of this conference was to examine the accumulating evidence on the role of physical activity in the prevention and treatment of CVD and its risk factors.

Physical activity in this statement is defined as "bodily movement produced by skeletal muscles that requires energy expenditure" and produces overall health benefits. Exercise, a type of physical activity, is defined as "a planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness." Physical inactivity denotes a level of activity less than that needed to maintain good health.

Physical inactivity characterizes most Americans. Exertion has been systematically engineered out of most occupations and lifestyles. In 1991, 54% of adults reported little or no regular leisure

Special Communication

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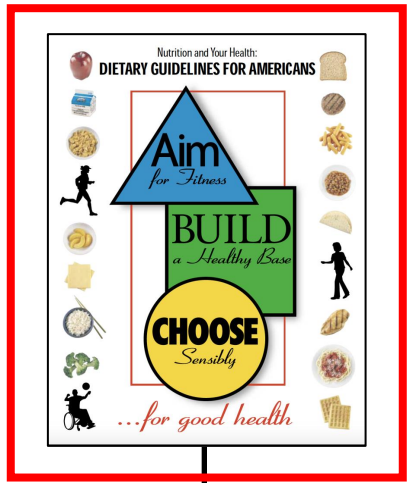

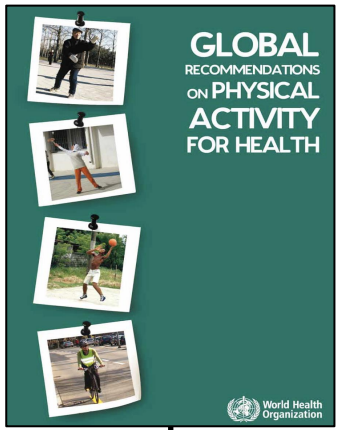

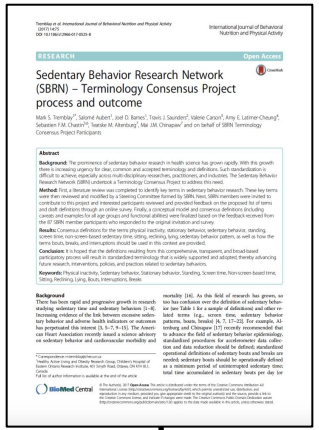

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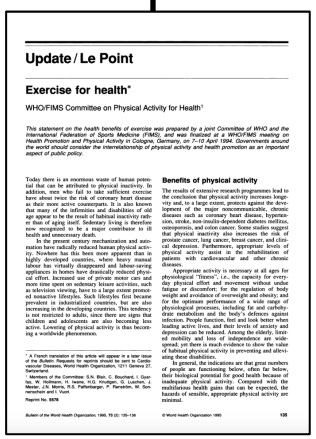

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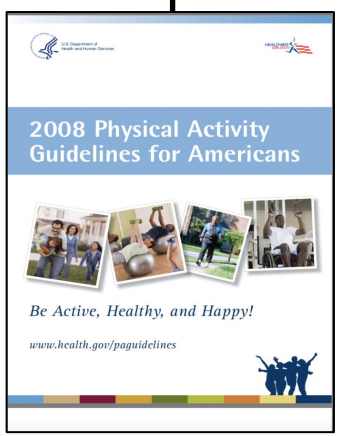
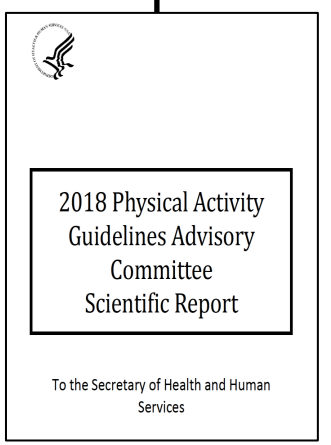
Physical Activity and Cardiovascular Health



DISCUSSION / DISCUSSION

Letter to the Editor: Standardized use of the terms "sedentary" and "sedentary behaviours"

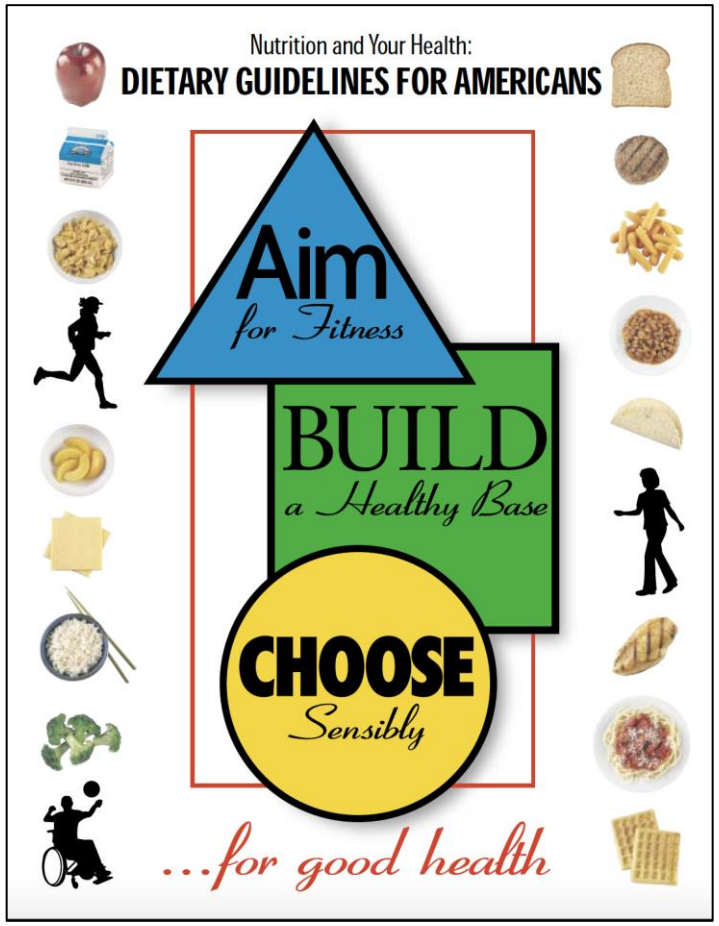
Sedentary Behaviour Research Network



2018 Physical Activity Guidelines Advisory Committee Scientific Report

To the Secretary of Health and Human Services

USDA / HHS - 2000

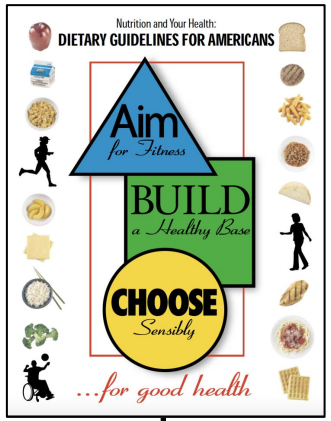


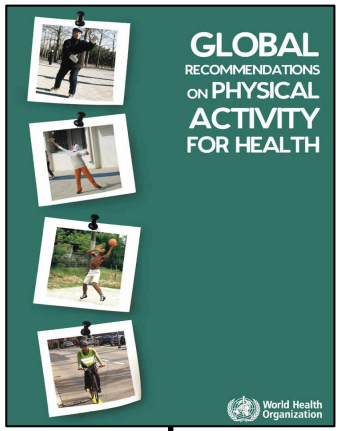
- El capítulo de actividad física de las guías dietarias del 2000
- Acumular al menos 30 minutos (adultos) o 60 Minutos (niños) de actividad física moderada la mayoría de días de la semana, preferentemente a diario.
- Si ya realiza 30 minutos de actividad física todos los días, puedes ganar incluso más beneficios para la salud al aumentar la cantidad o intensidad de la actividades.
- La actividad puede hacerse toda de una vez, o repartirda en dos o tres veces durante el día.

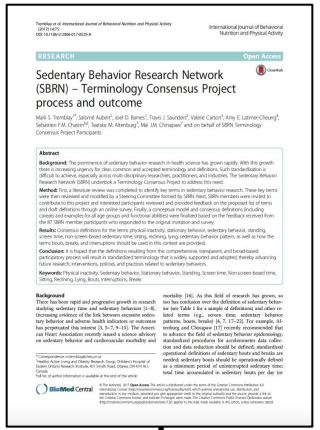
Special Communication

Physical Activity and Public Health

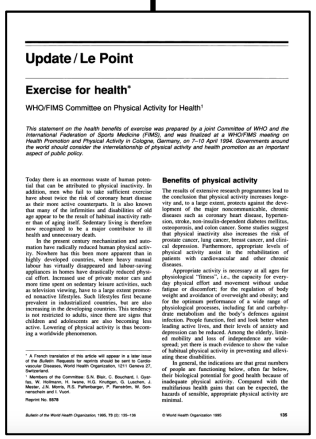
A Recommendation From the Centers for Disease Control and Prevention and the American College of Sports Medicine







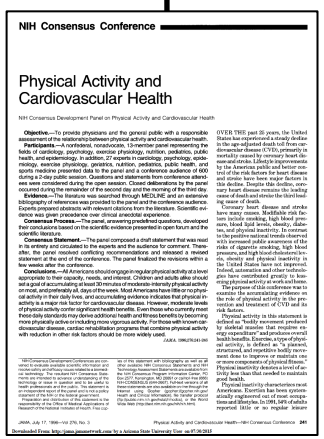
Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome



Update / Le Point

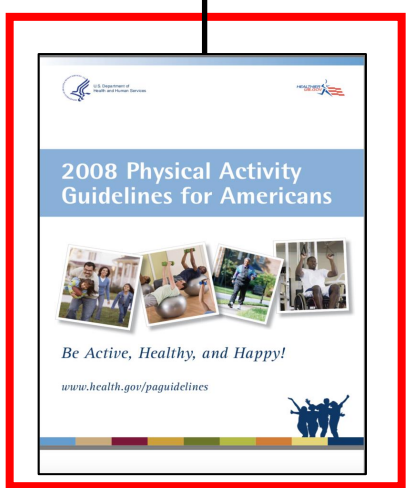
Exercise for health*

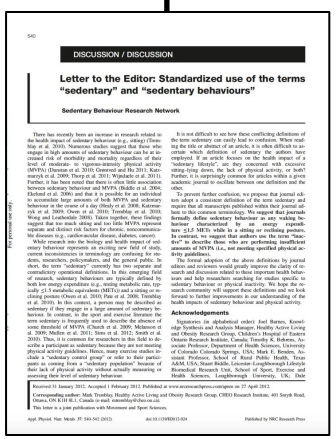
WHO/FIMS Committee on Physical Activity for Health†



NIH Consensus Conference

Physical Activity and Cardiovascular Health





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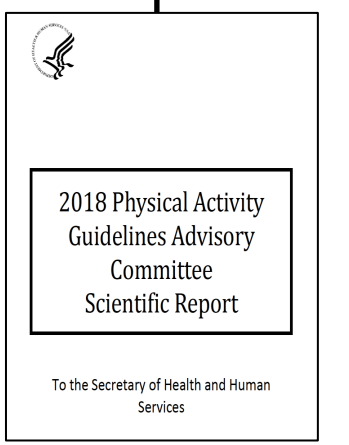


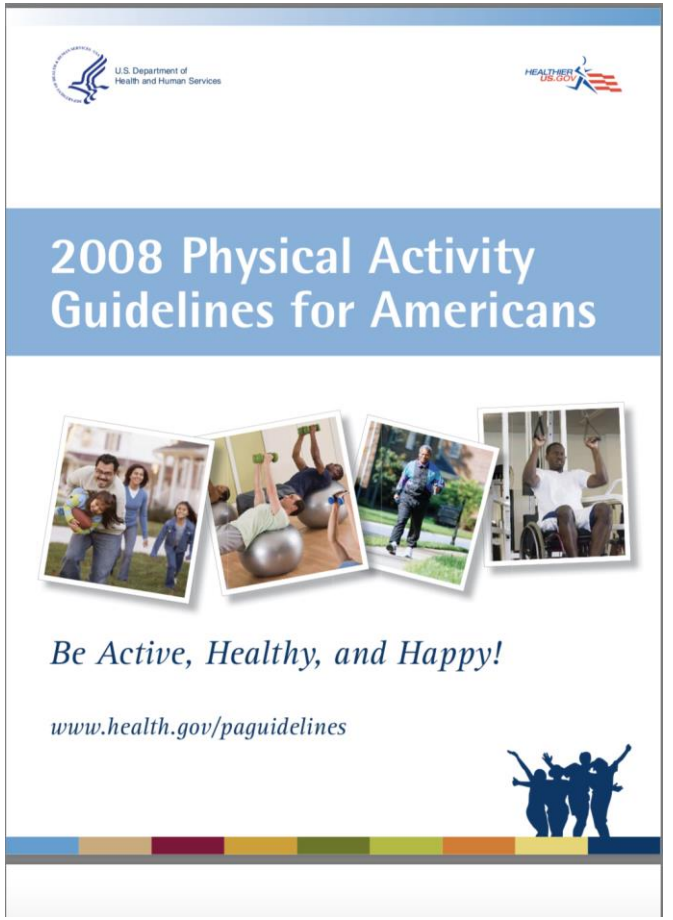
2018 Physical Activity Guidelines Advisory Committee Scientific Report

To the Secretary of Health and Human Services

1995 1996 2000 2008 2010 2012 2017 2018

HHS – 2008

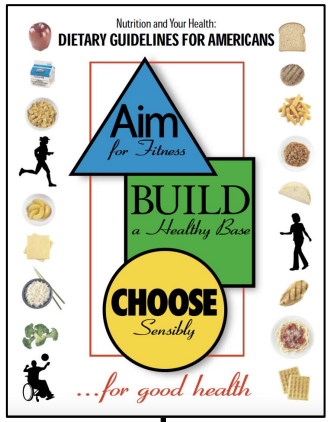
- Todos los adultos deben evitar inactividad. Cierta actividad física es mejor que ninguna, y los adultos que participan en cualquier cantidad de actividad física obtienen algunos beneficios para la salud.
- Para obtener beneficios sustanciales para la salud, los adultos deben hacer por lo menos 150 minutos (2 horas y 30 minutos) por semana de intensidad moderada, o 75 minutos (1 hora y 15 minutos) por semana de actividad física aeróbica de intensidad vigorosa, o una combinación equivalente De actividad aeróbica de intensidad moderada y vigorosa. La actividad aeróbica se debe realizar en episodios de al menos 10 minutos, y preferiblemente, debe extenderse durante toda la semana.
- Para obtener beneficios de salud adicionales y más extensos, los adultos deben aumentar su actividad física aeróbica a 300 minutos (5 horas) por semana de intensidad moderada, o 150 minutos a la semana de actividad física aeróbica de intensidad vigorosa, o una combinación equivalente de moderada y vigorosa actividad de intensidad. Se obtienen beneficios de salud adicionales al realizar actividad física más allá de esta cantidad.
- Los adultos también deben realizar actividades de fortalecimiento muscular de intensidad moderada o alta e involucrar a todos los grupos musculares principales durante 2 o más días a la semana, ya que estas actividades brindan beneficios adicionales para la salud.

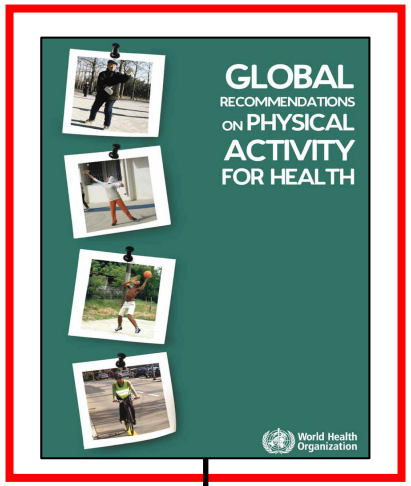


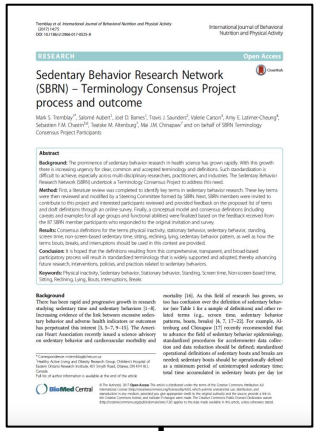
Special Communication

Physical Activity and Public Health

A Recommendation From the Centers for Disease Control and Prevention and the American College of Sports Medicine







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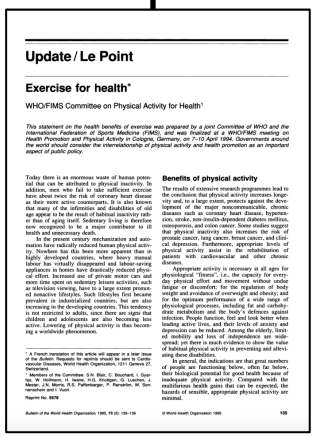
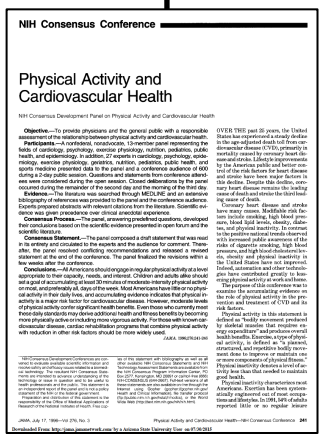


Update / Le Point

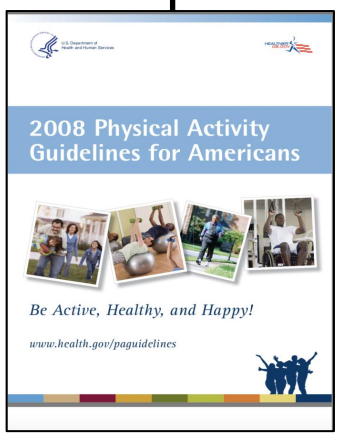
Exercise for health*

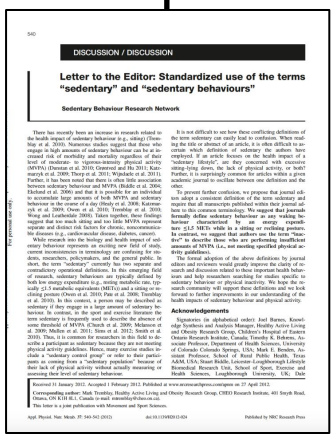
WHO/FIMS Committee on Physical Activity for Health†



NIH Consensus Conference

Physical Activity and Cardiovascular Health





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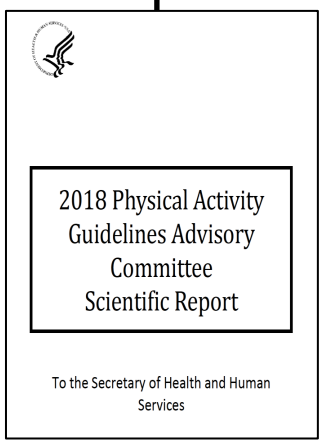


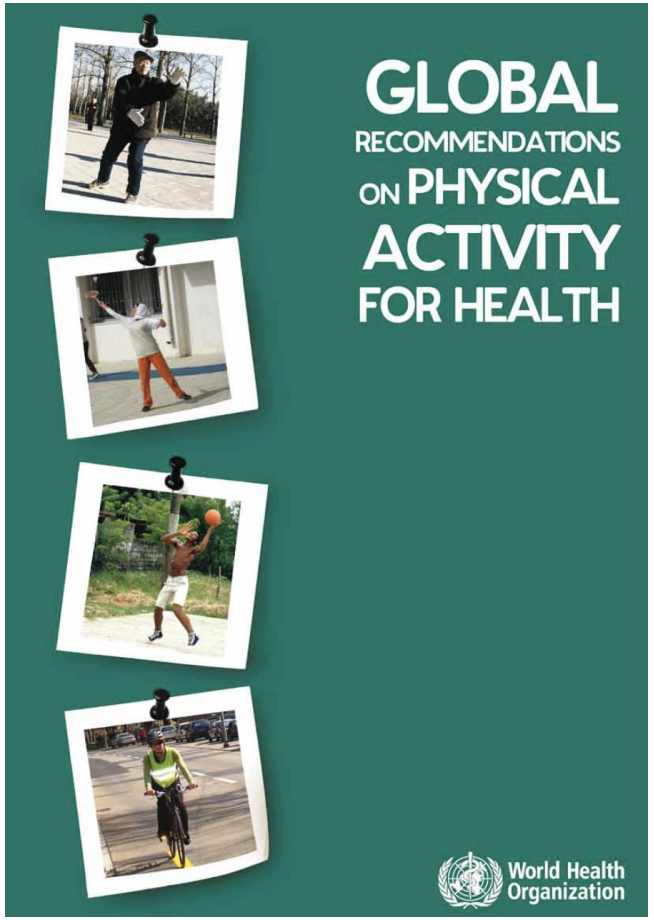
2018 Physical Activity Guidelines Advisory Committee Scientific Report

To the Secretary of Health and Human Services

1995 1996 2000 2008 2010 2012 2017 2018

OMS - 2010

- Los adultos de 18 a 64 años deberían acumular un mínimo de 150 minutos semanales de actividad física aeróbica moderada, o bien 75 minutos de actividad física aeróbica vigorosa cada semana, o bien una combinación equivalente de actividades moderadas y vigorosas.
- La actividad aeróbica se practicará en sesiones de 10 minutos de duración, como mínimo.
- Que, a fin de obtener aún mayores beneficios para la salud, los adultos de este grupo de edades aumenten hasta 300 minutos por semana la práctica de actividad física moderada aeróbica, o bien hasta 150 minutos semanales de actividad física intensa aeróbica, o una combinación equivalente de actividad moderada y vigorosa.
- Dos veces o más por semana, realicen actividades de fortalecimiento de los grandes grupos musculares.



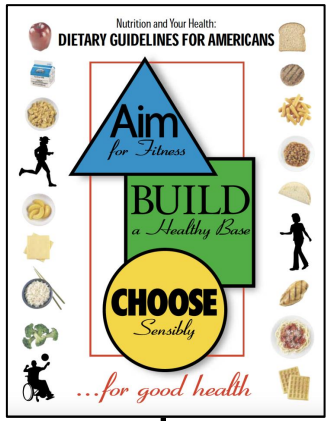
Recomendaciones actuales

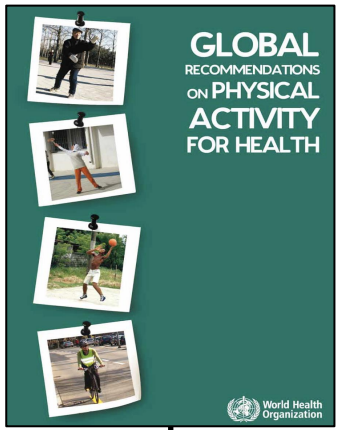
- Recomendaciones por rangos de edades (niños-jóvenes, adultos, adultos mayores...).
- Otras recomendaciones nacionales.
- Evidencia creciente.

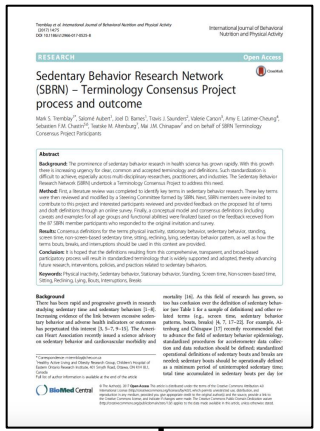
Special Communication

Physical Activity and Public Health

A Recommendation From the Centers for Disease Control and Prevention and the American College of Sports Medicine

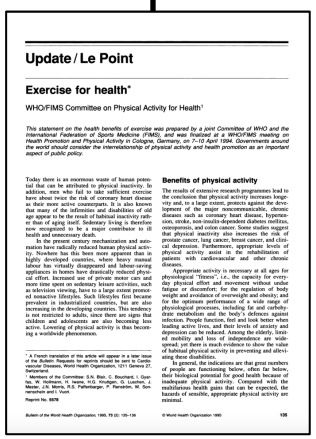






RESEARCH

Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome



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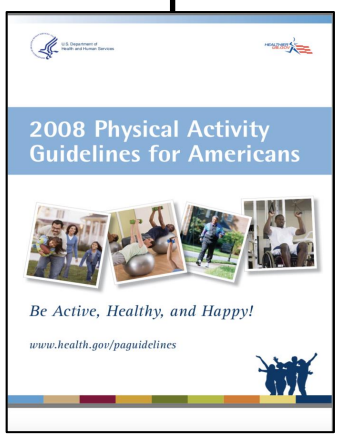
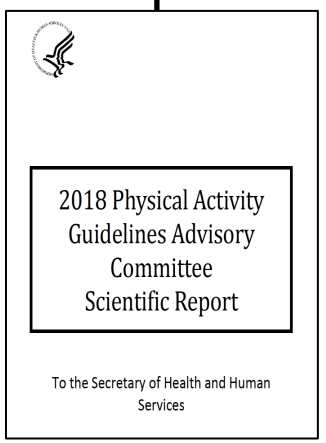


DISCUSSION / DISCUSSION

Letter to the Editor: Standardized use of the terms "sedentary" and "sedentary behaviours"

Sedentary Behaviour Research Network



2018 Physical Activity Guidelines Advisory Committee Scientific Report

To the Secretary of Health and Human Services

1995

1996

2000

2008

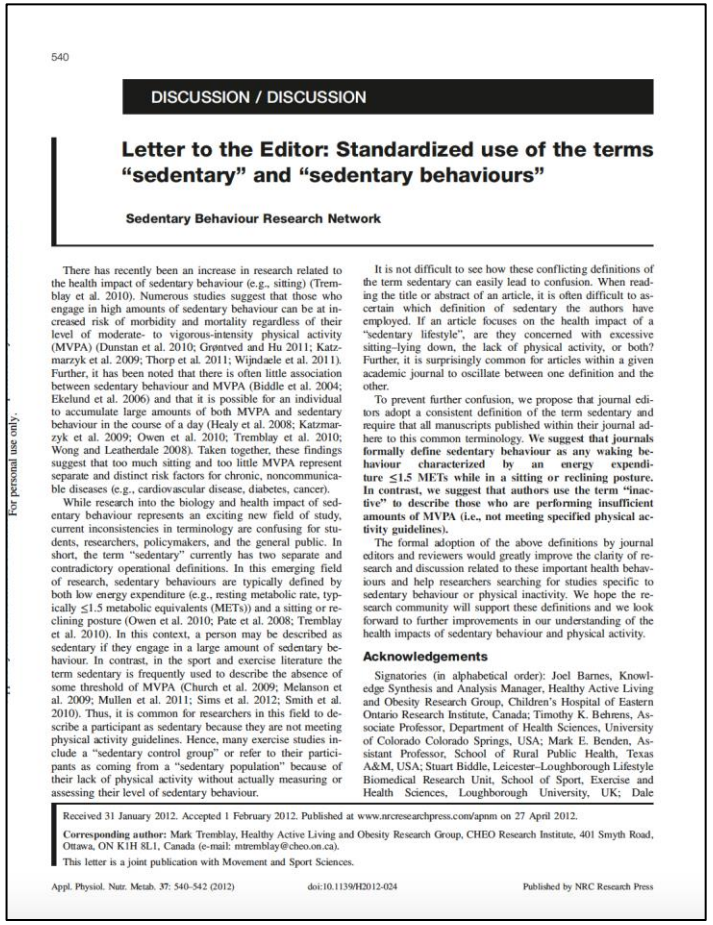
2010

2012

2017

2018

SBRN - 2012



Letter to the Editor: Standardized use of the terms "sedentary" and "sedentary behaviours"

Sedentary Behaviour Research Network

There has recently been an increase in research related to the health impact of sedentary behaviour (e.g., sitting) (Tremblay et al. 2010). Numerous studies suggest that those who engage in high amounts of sedentary behaviour can be at increased risk of morbidity and mortality regardless of their level of moderate- to vigorous-intensity physical activity (MVPA) (Dunstan et al. 2010; Grøntved and Hu 2011; Katzmarzyk et al. 2009; Thorp et al. 2011; Wijndaele et al. 2011). Further, it has been noted that there is often little association between sedentary behaviour and MVPA (Biddle et al. 2004; Ekelund et al. 2006) and that it is possible for an individual to accumulate large amounts of both MVPA and sedentary behaviour in the course of a day (Healy et al. 2008; Katzmarzyk et al. 2009; Owen et al. 2010; Tremblay et al. 2010; Wong and Leatherdale 2008). Taken together, these findings suggest that too much sitting and too little MVPA represent separate and distinct risk factors for chronic, noncommunicable diseases (e.g., cardiovascular disease, diabetes, cancer).

While research into the biology and health impact of sedentary behaviour represents an exciting new field of study, current inconsistencies in terminology are confusing for students, researchers, policymakers, and the general public. In short, the term "sedentary" currently has two separate and contradictory operational definitions. In this emerging field of research, sedentary behaviours are typically defined by both low energy expenditure (e.g., resting metabolic rate, typically ≤1.5 metabolic equivalents (METs)) and a sitting or reclining posture (Owen et al. 2010; Pate et al. 2008; Tremblay et al. 2010). In this context, a person may be described as sedentary if they engage in a large amount of sedentary behaviour. In contrast, in the sport and exercise literature the term sedentary is frequently used to describe the absence of some threshold of MVPA (Church et al. 2009; Melanson et al. 2009; Mullen et al. 2011; Sims et al. 2012; Smith et al. 2010). Thus, it is common for researchers in this field to describe a participant as sedentary because they are not meeting physical activity guidelines. Hence, many exercise studies include a "sedentary control group" or refer to their participants as coming from a "sedentary population" because of their lack of physical activity without actually measuring or assessing their level of sedentary behaviour.

It is not difficult to see how these conflicting definitions of the term sedentary can easily lead to confusion. When reading the title or abstract of an article, it is often difficult to ascertain which definition of sedentary the authors have employed. If an article focuses on the health impact of a "sedentary lifestyle", are they concerned with excessive sitting–lying down, the lack of physical activity, or both? Further, it is surprisingly common for articles within a given academic journal to oscillate between one definition and the other.

To prevent further confusion, we propose that journal editors adopt a consistent definition of the term sedentary and require that all manuscripts published within their journal adhere to this common terminology. **We suggest that journals formally define sedentary behaviour as any waking behaviour characterized by an energy expenditure ≤1.5 METs while in a sitting or reclining posture. In contrast, we suggest that authors use the term "inactive" to describe those who are performing insufficient amounts of MVPA (i.e., not meeting specified physical activity guidelines).**

The formal adoption of the above definitions by journal editors and reviewers would greatly improve the clarity of research and discussion related to these important health behaviours and help researchers searching for studies specific to sedentary behaviour or physical inactivity. We hope the research community will support these definitions and we look forward to further improvements in our understanding of the health impacts of sedentary behaviour and physical activity.

Acknowledgements

Signatories (in alphabetical order): Joel Barnes, Knowledge Synthesis and Analysis Manager, Healthy Active Living and Obesity Research Group, Children's Hospital of Eastern Ontario Research Institute, Canada; Timothy K. Behrens, Associate Professor, Department of Health Sciences, University of Colorado Colorado Springs, USA; Mark E. Benden, Assistant Professor, School of Rural Public Health, Texas A&M, USA; Stuart Biddle, Leicester–Loughborough Lifestyle Biomedical Research Unit, School of Sport, Exercise and Health Sciences, Loughborough University, UK; Dale

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Corresponding author: Mark Tremblay, Healthy Active Living and Obesity Research Group, CHEO Research Institute, 401 Smyth Road, Ottawa, ON K1H 8L1, Canada (e-mail: mtremblay@cheo.on.ca).

This letter is a joint publication with Movement and Sport Sciences.

- Estar sentados o ver televisión como comportamientos sedentarios (Hamilton et al., 2007)
- Diferenciación entre comportamientos sedentarios [1.0-1.5 METs] y actividad física ligera [1.6-2.9 METs] (Pate et al. 2008)
- Contextos/dominios: desplazamiento, trabajo, el ambiente doméstico y durante el tiempo libre (Owen et al., 2010)
- Carta al editor de "Applied Physiology, Nutrition, and Metabolism", diferenciación entre comportamientos sedentarios e inactividad (SBRN, 2012)

Special Communication

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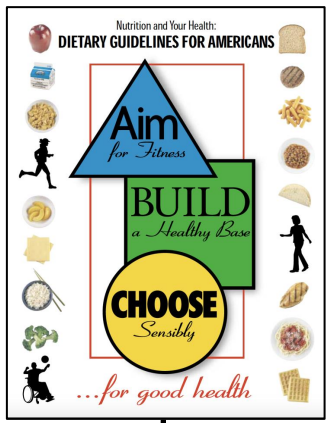

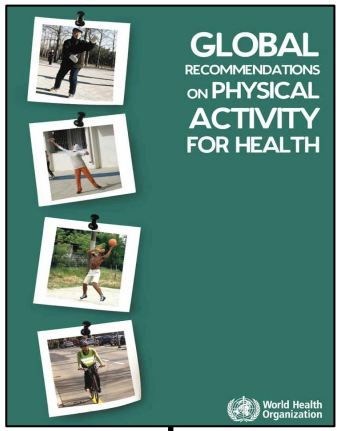

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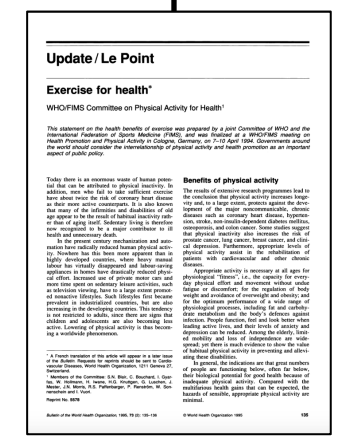

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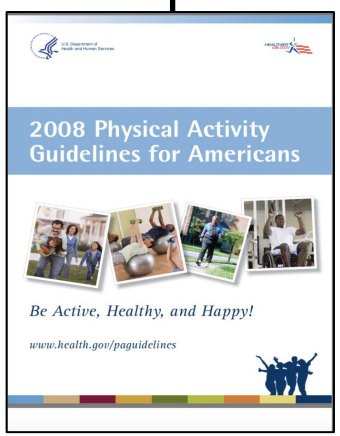

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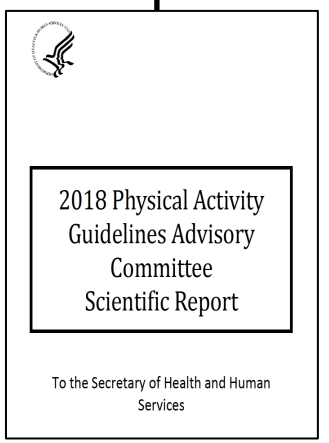


2018 Physical Activity Guidelines Advisory Committee Scientific Report

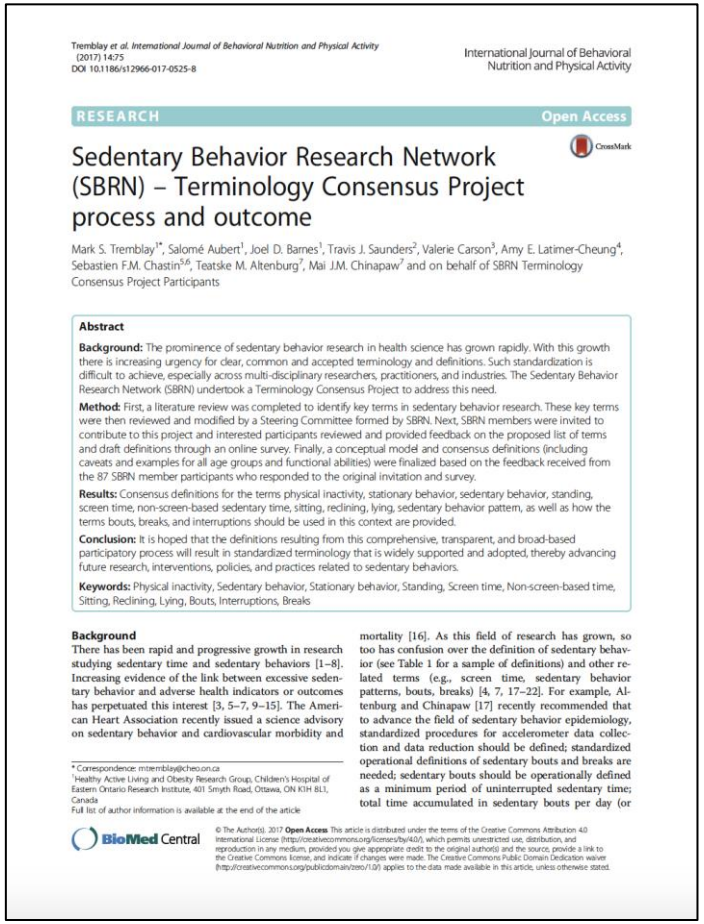
To the Secretary of Health and Human Services

1995 1996 2000 2008 2010 2012 2017 2018

SBRN - 2017

- Se considera **comportamiento sedentario** a cualquier actividad realizada por el individuo en posición sentada o inclinada con un gasto energético ≤ 1.5 METs, mientras se está despierto.

- El término sedentario se ha usado para describir insuficiente MVPA para cumplir con las recomendaciones de actividad física, pero no altas cantidades de tiempo sedentario. **(Inactivo)**



Tremblay et al. International Journal of Behavioral Nutrition and Physical Activity (2017) 14:75
DOI 10.1186/s12966-017-0525-8

International Journal of Behavioral Nutrition and Physical Activity

RESEARCH Open Access

Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome

Mark S. Tremblay[1*], Salomé Aubert[1], Joel D. Barnes[1], Travis J. Saunders[2], Valerie Carson[3], Amy E. Latimer-Cheung[4], Sebastien F.M. Chastin[5,6], Teatske M. Altenburg[7], Mai J.M. Chinapaw[7] and on behalf of SBRN Terminology Consensus Project Participants

Abstract

Background: The prominence of sedentary behavior research in health science has grown rapidly. With this growth there is increasing urgency for clear, common and accepted terminology and definitions. Such standardization is difficult to achieve, especially across multi-disciplinary researchers, practitioners, and industries. The Sedentary Behavior Research Network (SBRN) undertook a Terminology Consensus Project to address this need.

Method: First, a literature review was completed to identify key terms in sedentary behavior research. These key terms were then reviewed and modified by a Steering Committee formed by SBRN. Next, SBRN members were invited to contribute to this project and interested participants reviewed and provided feedback on the proposed list of terms and draft definitions through an online survey. Finally, a conceptual model and consensus definitions (including caveats and examples for all age groups and functional abilities) were finalized based on the feedback received from the 87 SBRN member participants who responded to the original invitation and survey.

Results: Consensus definitions for the terms physical inactivity, stationary behavior, sedentary behavior, standing, screen time, non-screen-based sedentary time, sitting, reclining, lying, sedentary behavior pattern, as well as how the terms bouts, breaks, and interruptions should be used in this context are provided.

Conclusion: It is hoped that the definitions resulting from this comprehensive, transparent, and broad-based participatory process will result in standardized terminology that is widely supported and adopted, thereby advancing future research, interventions, policies, and practices related to sedentary behaviors.

Keywords: Physical inactivity, Sedentary behavior, Stationary behavior, Standing, Screen time, Non-screen-based time, Sitting, Reclining, Lying, Bouts, Interruptions, Breaks

Background

There has been rapid and progressive growth in research studying sedentary time and sedentary behaviors [1–8]. Increasing evidence of the link between excessive sedentary behavior and adverse health indicators or outcomes has perpetuated this interest [3, 5–7, 9–15]. The American Heart Association recently issued a science advisory on sedentary behavior and cardiovascular morbidity and mortality [16]. As this field of research has grown, so too has confusion over the definition of sedentary behavior (see Table 1 for a sample of definitions) and other related terms (e.g., screen time, sedentary behavior patterns, bouts, breaks) [4, 7, 17–22]. For example, Altenburg and Chinapaw [17] recently recommended that to advance the field of sedentary behavior epidemiology, standardized procedures for accelerometer data collection and data reduction should be defined; standardized operational definitions of sedentary bouts and breaks are needed; sedentary bouts should be operationally defined as a minimum period of uninterrupted sedentary time; total time accumulated in sedentary bouts per day (or

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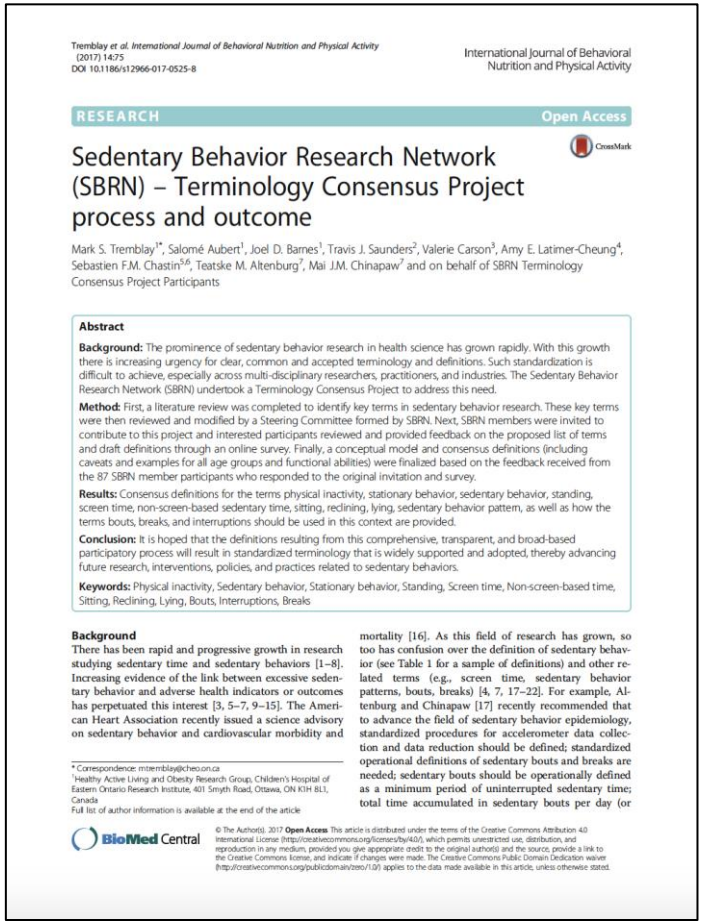
SBRN - 2017

- Comportamiento sedentario
- Inactividad física
- Comportamiento estacionario
- Tiempo de pantalla
- Etc.



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International Journal of Behavioral Nutrition and Physical Activity

RESEARCH Open Access

Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome

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Abstract

Background: The prominence of sedentary behavior research in health science has grown rapidly. With this growth there is increasing urgency for clear, common and accepted terminology and definitions. Such standardization is difficult to achieve, especially across multi-disciplinary researchers, practitioners, and industries. The Sedentary Behavior Research Network (SBRN) undertook a Terminology Consensus Project to address this need.

Method: First, a literature review was completed to identify key terms in sedentary behavior research. These key terms were then reviewed and modified by a Steering Committee formed by SBRN. Next, SBRN members were invited to contribute to this project and interested participants reviewed and provided feedback on the proposed list of terms and draft definitions through an online survey. Finally, a conceptual model and consensus definitions (including caveats and examples for all age groups and functional abilities) were finalized based on the feedback received from the 87 SBRN member participants who responded to the original invitation and survey.

Results: Consensus definitions for the terms physical inactivity, stationary behavior, sedentary behavior, standing, screen time, non-screen-based sedentary time, sitting, reclining, lying, sedentary behavior pattern, as well as how the terms bouts, breaks, and interruptions should be used in this context are provided.

Conclusion: It is hoped that the definitions resulting from this comprehensive, transparent, and broad-based participatory process will result in standardized terminology that is widely supported and adopted, thereby advancing future research, interventions, policies, and practices related to sedentary behaviors.

Keywords: Physical inactivity, Sedentary behavior, Stationary behavior, Standing, Screen time, Non-screen-based time, Sitting, Reclining, Lying, Bouts, Interruptions, Breaks

Background

There has been rapid and progressive growth in research studying sedentary time and sedentary behaviors [1–8]. Increasing evidence of the link between excessive sedentary behavior and adverse health indicators or outcomes has perpetuated this interest [3, 5–7, 9–15]. The American Heart Association recently issued a science advisory on sedentary behavior and cardiovascular morbidity and mortality [16]. As this field of research has grown, so too has confusion over the definition of sedentary behavior (see Table 1 for a sample of definitions) and other related terms (e.g., screen time, sedentary behavior patterns, bouts, breaks) [4, 7, 17–22]. For example, Altenburg and Chinapaw [17] recently recommended that to advance the field of sedentary behavior epidemiology, standardized procedures for accelerometer data collection and data reduction should be defined; standardized operational definitions of sedentary bouts and breaks are needed; sedentary bouts should be operationally defined as a minimum period of uninterrupted sedentary time; total time accumulated in sedentary bouts per day (or

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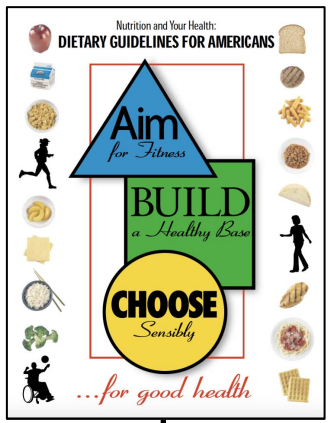
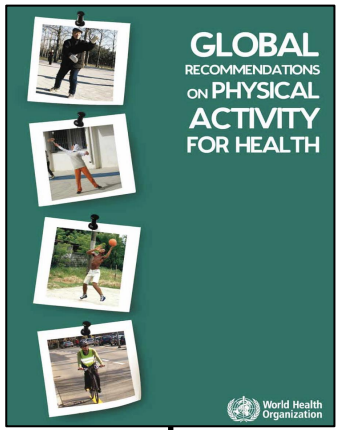
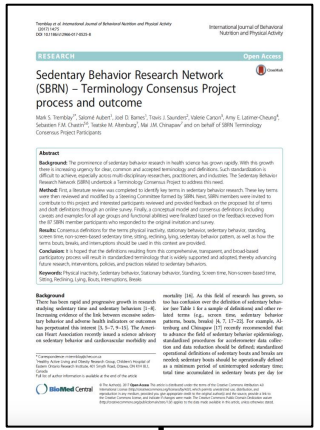
Special Communication

Physical Activity and Public Health

A Recommendation From the Centers for Disease Control and Prevention and the American College of Sports Medicine

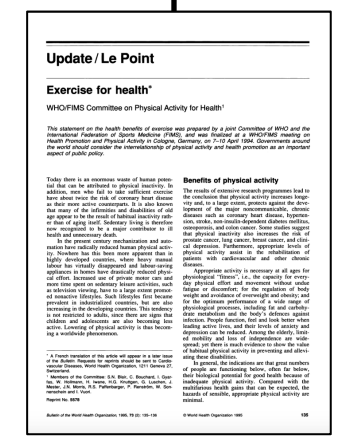






RESEARCH Open Access

Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome



Update / Le Point

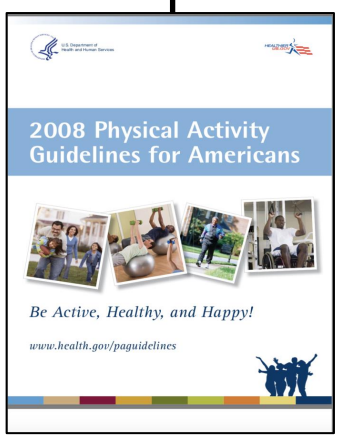
Exercise for health*

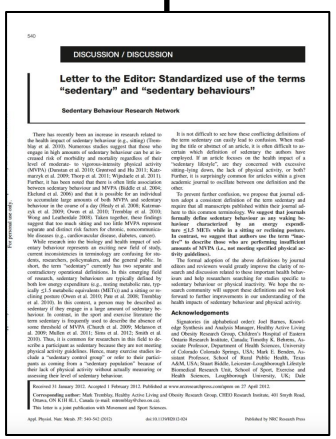
WHO/FIMS Committee on Physical Activity for Health†

NIH Consensus Conference

Physical Activity and Cardiovascular Health

NIH Consensus Development Panel on Physical Activity and Cardiovascular Health

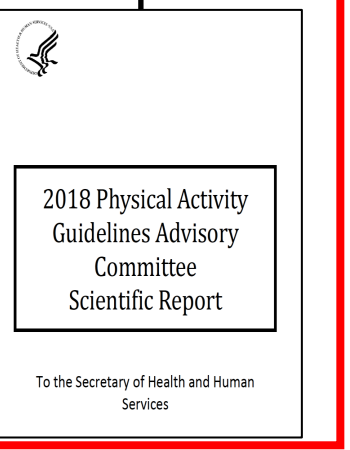




DISCUSSION / DISCUSSION

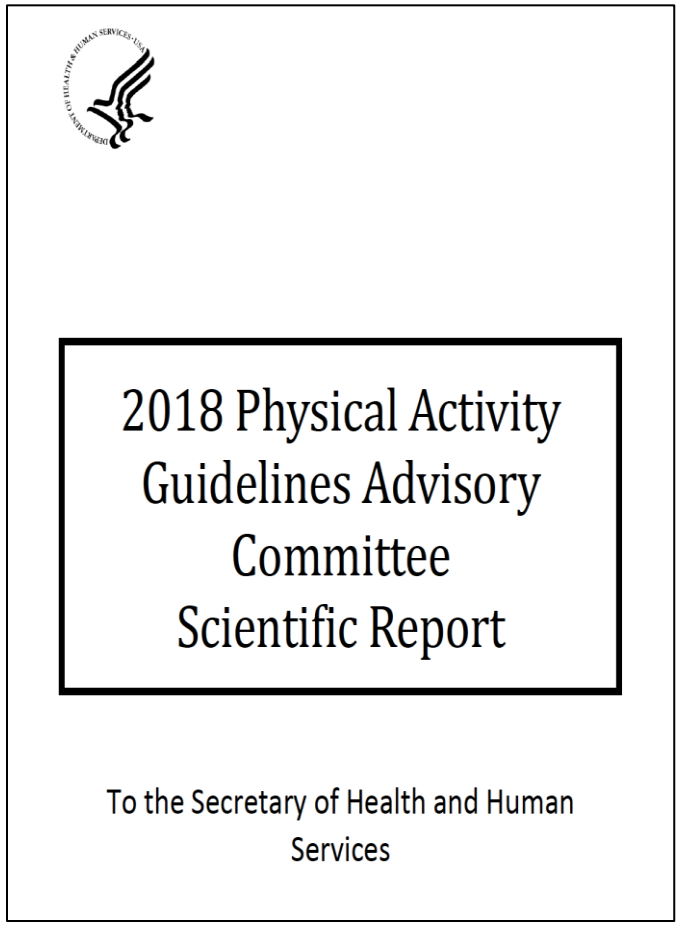
Letter to the Editor: Standardized use of the terms "sedentary" and "sedentary behaviours"

Sedentary Behaviour Research Network



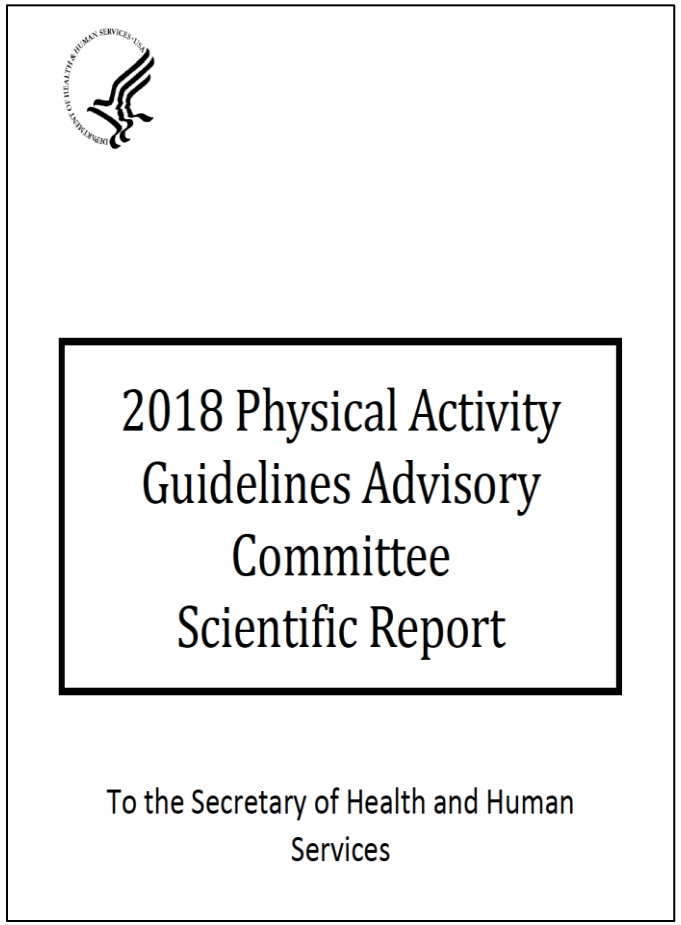
1995 1996 2000 2008 2010 2012 2017 2018

HHS - 2018



- Revisiones sistemáticas, metanálisis e informes gubernamentales que cumplieron con los criterios de elegibilidad del Comité Asesor.
- 2011-2016.
- Actividad física y comportamientos sedentarios.

HHS - 2018



PAGAC Limitada

- Área/temática emergente que aún no ha recibido suficiente atención de la comunidad científica para lograr una calificación más alta.
- Diseños y métodos menos rigurosos, tamaños de muestra pequeños y períodos de intervención cortos.

PAGAC Moderada

- Más estudios disponibles mostrando un efecto más consistente.
- Diseños más rigurosos.

PAGAC Fuerte

- Gran cantidad de estudios disponibles
- Más rigurosamente
- Efectos positivos más consistentes en periodos más prolongados.

¿Qué viene?

- Comportamientos sedentarios
- Actividad física ligera
- Duración de sesiones <10 minutos.
- …

Gracias por su amable atención