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SPORT ACTIVITY AND PERSONALITY AS ELEMENTS IN PREVENTING CANCER AND CORONARY HEART DISEASE[1]

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Summary.—Results are reported for 3 groups of healthy male probands, 318 in each group, matched for age and personality type on the Personality-Stress Questionnaire. One group was actively engaged in sports, one had discontinued former sporting activities, and one group had never taken part in regular sports. Follow-up after 13 yr. showed lowest mortality in those actively engaged in sport, highest mortality in those who had given up sport, with those who had never been engaged in sport intermediate. Prophylactic behaviour therapy was shown to reduce mortality of those who had given up sport to a significant extent but not to affect degree of retinal sclerosis.

There is a good deal of evidence that personality and stress exert a powerful influence on a person's likelihood to develop cancer or coronary heart disease (CHD) (Kissen & Eysenck, 1962; Grossarth-Maticek, Kanazir, Vetter, & Schmidt, 1983; Grossarth-Maticek, Schmidt, & Vetter, 1985; Grossarth-Maticek, Bastiaans, & Kanazir, 1985; Eysenck, 1985, 1987a, 1987b, 1988a, 1988b, 1990; Wirsching, Stierlin, Hoffmann, Weber, & Wirsching, 1982; van der Ploeg, Kleijn, Mook, Hunge, Pieters, & Leer, 1989). Typically, cancer-prone people are characterized as overly cooperative, pleasing, unassertive, over-patient, conflict avoiding, harmony seeking, compliant, defensive, emotion suppressing, and unable to deal with interpersonal stress, which leads to feelings of hopelessness/helplessness, and finally to depression (Baltrusch, Stangel, & Waltz, 1988).

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Coronary heart disease-prone people, on the other hand, are characterized by strong feelings of anger, by aggression and hostility, but not by many other of the so-called Type A characteristics (Booth-Kewley & Friedman, 1987; Chesney & Rosenman, 1985; Eysenck, 1990).

An inventory, Personality-Stress Questionnaire, specifically geared to the measurement of the cancer-prone and the coronary heart disease-prone personality, based on our earlier researches, has been published, together with evidence for reliability and validity (Grossarth-Maticek & Eysenck, 1990). The inventory contains questions relating to six separate personality types. In addition to the cancer-prone and the CHD-prone types (Type 1 and Type 2), there are Type 3 who are psychopathic in behaviour and Type 4 who show normal, autonomous behaviour, Type 5 who are rational and antiemotional, and Type 6 who are antisocial. Types 1, 2 and 5 are particularly prone to disease, while Types 3, 4 and 6 are relatively immune.

Our particular interest here is the role of mediating factors between personality/stress and disease. Eysenck (1989a, 1989b, in press) has outlined a theory linking the failure to cope with stress which is characteristic of Type 1, with subsequent feelings of hopelessness, helplessness, and depression, leading in turn to a rise in systemic cortisol level. Cortisol is known to be immunosuppressive, thereby lowering the resistance of the person to the frequently budding cancer cells and finally leading to cancer. Grossarth-Maticek and Eysenck have also shown that the immune system can be directly influenced through behaviour therapy (1989), and generally there is evidence that both cancer and coronary heart disease can be prevented by the prophylactic use of behaviour therapy (Eysenck & Grossarth-Maticek, 1989). Coronary heart disease seems to be related to atherosclerosis, and a strong relationship between Type 2 and the development of atherosclerosis has been demonstrated (Grossarth-Maticek, Eysenck, Gallasch, Vetter, & Frentzel-Beyme, in press).

The present paper is concerned with one possible link in this chain. We have found in the past that behaviour therapy led to successful changing of behaviour patterns of Type 1 or Type 2 persons in the direction of those characteristic of Type 4, the healthy, autonomous type (Grossarth-Maticek, Eysenck, & Vetter, 1988). There were no changes in smoking habit, but there were changes in mobility, i.e., in the amount of jogging, sport, etc. in which the probands engage. This suggests that sport may be an active factor in keeping a person healthy, and the present study was designed to investigate this possibility.

The Study

(a) *Sport and Mortality*

There is much evidence that physical fitness is important in maintaining

health and avoiding cancer and coronary heart disease. Substantial evidence suggests that regular physical activity is associated with reduced risk of CHD (Morris, Everitt, Pollard, Chave, & Semmend, 1980; Paffenbarger & Hale, 1975; Paffenbarger, Hyde, Wing, & Hsieh, 1984; Siscovick, Weiss, Hallstrom, Inui, & Petersen, 1982; Leon, Connett, Jacobs, & Raumara, 1987). Physical fitness predicts low cardiovascular mortality (Ekelund, Haskell, Johnson, Whaley, Criqui, & Sheps, 1988; Fobsom, Caspersen, & Taylor, 1985; La Porte, Dearwater, Cauley, Slemenda, & Cook, 1985; Powell, Thompson, Caspersen, & Kendrick, 1987), but it is also related to low incidence of cancer and other causes of death (all other causes of mortality) (Blair, Kohl, Paffenbarger, Clark, Cooper, & Gibbons, 1989; Paffenbarger, Hyde, Wing, & Hsieh, 1986; Veng, Graham, Zielezay, Swanson, Barnes, & Nolan, 1985). These papers make a persuasive case, but they throw no light on the fate of people who quit regular physical activity in middle age or on the important question of the relations among personality, sporting activity, and disease. It is these two issues which are our main concern, although we shall also present evidence to support the major conclusion that physical activity protects the individual against disease, particularly cancer and coronary heart disease.

We selected subjects from a large randomly selected group of about 16,000 men, aged 40 yr. and older, who had been administered the personality questionnaire, to make up three groups. The first group was characterized by being actively engaged in sport. "Being active in sport" was defined as being engaged three times a week for more than two hours in a particular sport, so that the proband would be regarded as an accomplished participant. The second group was characterized by having earlier been engaged in sport but having discontinued this practice, i.e., not having taken part in any sports during the past 10 to 25 yr. Finally, members of the third group had never engaged in any regular sporting activities.

The great majority of sports considered in our study were individual (tennis, badminton, table tennis), group (football, handball, hockey) games, or field athletics (running, jumping, hurdling), with smaller numbers in the discus- or javelin-throwing groups. A reasonably high standard was demanded to mark a clear distinction between participants and nonparticipants.

All participants were male, healthy at the beginning of the investigation, and averaged 56 yr. of age for all groups and subgroups. There were 318 members in each of the three groups, divided by type, so that for each group there would be 53 members for each of the six types. The large number of subjects in the total sample made exact matching possible. Different selections were involved in each of the studies reported here. Personality inventories were administered at the beginning of the study: after 13 yr. the health status of all probands was investigated, and enquiries made relating to

death from cancer, coronary heart disease, and from other causes, death certificates being the main evidence in each case. Significance tests were carried out according to the linear model with homogeneous error variance, properly testing the null hypothesis (Vetter, 1988). To attain a particular significance level, carried out on n tests, we used a significance level of $0.05/n$ so that the expectation of the number of falsely significant tests (Type 1 error) remains 0.05 regardless of the number of tests carried out. This is a necessary precaution where so many tests of significance are performed.

TABLE 1
PARTICIPATION IN SPORT, PERSONALITY TYPE AND MORTALITY FROM CANCER, CORONARY HEART DISEASE, AND OTHER CAUSES ($N = 318$)

Type		Active in Sport ($n = 53$)				Discontinued Sport ($n = 53$)				Never in Sport ($n = 53$)			
		Cancer	CHD	Other	Living	Cancer	CHD	Other	Living	Cancer	CHD	Other	Living
1	*f*	6	7	13	27	5	16	14	18	19	2	16	16
	%	11.3	13.0	24.5	50.9	9.4	30.1	26.4	33.9	5.8	3.7	30.1	30.1
2	*f*	1	19	10	23	3	28	13	9	10	11	14	18
	%	1.9	35.8	18.8	43.3	5.4	52.8	24.5	16.9	18.8	20.7	26.4	33.9
3	*f*	0	0	6	47	1	8	9	35	8	4	11	30
	%	0.0	0.0	11.3	88.6	1.9	15.1	16.9	66.0	15.1	7.5	20.7	56.6
4	*f*	0	0	3	50	0	6	8	39	5	3	7	38
	%	0.0	0.0	5.6	94.3	0.0	11.3	15.1	73.5	9.4	5.6	13.0	71.7
5	*f*	1	8	15	29	4	14	21	14	2	7	8	36
	%	1.9	15.1	28.3	54.7	7.5	26.4	39.6	26.4	3.8	13.0	15.1	67.9
6	*f*	1	5	14	33	1	9	19	24	6	1	7	39
	%	1.9	9.4	26.4	62.2	1.9	16.9	35.8	45.2	11.3	1.9	13.0	73.6
Σ	*f*	9	39	61	209	14	81	84	139	50	28	63	177
	%	2.8	12.2	19.2	65.7	4.4	25.4	26.4	43.7	15.7	8.8	19.8	55.6

The results of the study are shown in Table 1. The major results of the study may be summarized as follows. (1) Over-all, among probands engaging in active sport 66% are surviving, followed by 56% of never active probands, with those who discontinued sporting activities faring worst, as only 44% were surviving. These differences are statistically significant ($p < .001$). (2) Mortality is related to personality type ($p < .001$), with Types 1, 2 and 5, as expected, showing the fewest numbers still living, and significantly more Types 3, 4 and 6 surviving. (3) There is a significant ($p < .05$) interaction between sport and type. Only Type 2 shows the over-all pattern of active, discontinued and never active; for other types the sequence is different. For Types 5 and 6, those who never engaged in sport survived best, followed by those active in sport. For Types 1, 3, and 4 the active sport participants fare best, with little difference between those who discontinued and those who

never engaged in sport. (4) Cancer deaths are significantly higher for Type 1, and deaths from coronary heart disease for Type 2 ($p < .001$). This is very much in line with previous work (Eysenck, 1988a, 1988b).

We should note it would have been interesting to know how type was related to sport, i.e., whether in general Type 1 or Type 2 probands engaged less in sport than Type 3 and Type 4 probands. The structure of our sample makes such an analysis impossible, as we assigned equal numbers of each type to each condition.

(b) *Sclerosis and Mortality by Type and Sport*

In a previous study we have shown that sclerosis in the fundus of the eye differentiates significantly between probands of Type 1 and Type 2, with the latter, as expected, being afflicted more strongly (Grossarth-Maticek, Eysenck, Gallasch, Vetter, & Frentzel-Beyme, in press). We also found that less sclerosis was associated significantly with participation in behaviour therapy. In the present study we are concerned with the relationship between sport activity and sclerosis. Degree of sclerosis is measured on a 5-point scale, as described in Table 2.

TABLE 2
FIVE DEGREES OF SCLEROSIS IN FUNDUS OF THE EYE

Stage 0 (No evidence of sclerosis whatever)

Stage 1 (Red Fundus)
Of red color because of increased blood circulation in retinal vessels, dilation of congested arterioles (arterioles show same width as venules), omega-shaped branching of arterioles of first order or second order, golden reflex of vessels (copper-wire arteries), occasional periodvascular stripes, Gunn's phenomenon and Salus crossing, omega-shaped branching of venules, corkscrew-shaped venules around the macular with perimacular localized intraretinal hemorrhages, complicated at rare instances by apoplexia papillae.

Stage 2 (Pale Fundus)
Pale fundus because of reduced retinal circulation and reduced transparency due to gliosis retinae, stretching and constriction of arterioles (relation of arteriole/venule from 2:3 reduced to 1:4), silvery reflex of vessels (silver-wire arteries), variable calibers of arterioles, in red-free light blood-filled vessels accompanied by greyish-white stripes (vasosclerosis by fibrous reconstruction and hyalinose), Gunn's phenomenon and parallel Gunn's phenomenon as well as Salus crossing signs, exsudates, but no further neuroretinal changes.

Stage 3 (Cotton-wool Foci)
Stripe- and flame-shaped bleedings particularly around the papilla, cotton-wool foci, spotted star figure of the macula, oedema of the retina, in extreme cases exsudative ablation of the retina (oedema is difficult to recognize by funduscopy, because of the similar refraction index of the oedema), capillar ecstasias, unclear border of papilla.

Stage 4 (Cotton-wool Foci with Papilla Oedema)
In principle similar to Stage 3, however with more pronounced swelling of the papilla as well as heavy oedema of the retina and increasing capillar ecstasia. Acute changes are more prominent in Stage 4.

In this study we used three groups of 53 males each, matched for age and type. These were not identical with the groups discussed in the previous section. Degree of sclerosis was measured by an experienced ophthalmologist, and cause of death was established on the basis of death certificates, as in all our studies.

TABLE 3
SCLEROSIS AND PARTICIPATION IN SPORT AS RELATED TO MORTALITY

Category		Active in Sport (n = 53)				
		0*	1	2	3	4
n		8	11	16	11	6
Coronary Heart Disease	f	1	1	4	8	5
	%	12.5	9.0	25.0	72.7	83.3
Cancer	f	0	0	1	0	0
	%	0.0	0.0	6.2	0.0	0.0
Other Causes of Death	f	0	3	3	3	1
	%	0.0	27.2	18.7	27.2	16.7
Still Living	f	7	7	8	0	0
	%	87.5	63.6	50.0	0.0	0.0
		Discontinued Sport (n = 53)				
n		2	8	10	25	8
Coronary Heart Disease	f	0	1	2	19	6
	%	0.0	12.5	20.0	76.0	75.0
Cancer	f	1	1	1	0	0
	%	50.0	12.5	10.0	0.0	0.0
Other Causes of Death	f	0	1	4	6	2
	%	0.0	12.5	40.0	24.0	25.0
Still Living	f	1	5	3	0	0
	%	50.0	62.5	30.0	0.0	0.0
		Never in Sport (n = 53)				
n		11	17	15	9	1
Other Causes of Death	f	0	1	2	7	1
	%	0.0	5.8	13.3	77.7	100.0
Cancer	f	2	4	3	1	0
	%	18.1	23.5	20.0	11.0	0.0
Other Causes of Death	f	3	3	7	1	0
	%	27.2	17.6	46.6	11.1	0.0
Still Living	f	6	9	3	0	0
	%	54.5	52.9	20.0	0.0	0.0

*Degree of sclerosis.

Table 3 shows the degree of sclerosis in the sporting, discontinued, and inactive groups. It will be seen that the "discontinued" group has the highest (worst) score, with the "never" participating group having the best, i.e., showing the lowest degree of sclerosis. However, these differences are not statistically significant. A degree of sclerosis is clearly correlated over-all

with high mortality ($p < .001$). For cancer there is no significant relation, but there is for coronary heart disease, which is of course what one would have expected ($p < .001$). Clearly, active engagement in sport does not have a marked influence on sclerosis; if anything, the inactive group came off best.

(c) *Prophylactic Effects of Behaviour Therapy*

Two groups of 53 males each were randomly chosen (independent of those in the previous studies), matched on degree of sclerosis, age and type. All probands were selected from the group most in danger of coronary heart disease, namely, those who had discontinued sport for 10 to 25 yr. The therapy group was administered a written statement outlining the principles of

TABLE 4
EFFECT OF BEHAVIOUR THERAPY ON MORTALITY IN PROBANDS WHO DISCONTINUED SPORTING ACTIVITIES

Category		Control Group (n = 53)				
		0*	1	2	3	4
n		2	8	10	25	8
Coronary Heart Disease	f	0	1	2	19	6
	%	0.0	12.5	20.0	76.0	75.0
Cancer	f	1	1	1	0	0
	%	50.0	12.5	10.0	0.0	0.0
Other Causes of Death	f	0	1	4	6	2
	%	0.0	12.5	40.0	24.0	25.0
Still Living	f	1	5	3	0	0
	%	50.0	62.5	30.0	0.0	0.0
		Therapy Group (n = 53)				
n		2	10	8	24	9
Coronary Heart Disease	f	0	0	1	8	4
	%	0.0	0.0	12.5	33.3	44.4
Cancer	f	0	0	1	0	0
	%	0.0	0.0	12.5	0.0	0.0
Other Causes of Death	f	0	0	1	2	3
	%	0.0	0.0	12.5	8.3	12.5
Still Living	f	2	10	5	14	2
	%	100.0	100.0	62.5	58.3	22.2

*Degree of sclerosis.

our version of behaviour therapy, which was personally introduced in a one-hour discussion; during three hours following the original presentation the application of the principles as outlined in the written statement for the particular circumstances of the proband was discussed (Grossarth-Maticek & Eysenck, in press; Eysenck & Grossarth-Maticek, in press). The control group was not subjected to any form of intervention.

The aim of the particular system of behaviour therapy, Creative

Novation Behaviour Therapy (Grossarth-Maticek & Eysenck, in press), is to make subjects more autonomous in their behaviour and less dependent on other people, situations, etc. The method attempts to change behaviour from that characteristic of Types 1 and 2 to that characteristic of Type 4. The traditional approaches of behaviour therapy are used, relaxation, desensitization, suggestion, hypnosis, modeling, etc.; the only difference is the aim, which is to alter behaviour in a specific direction, rather than to eliminate specific anxieties and phobias (Grossarth-Maticek, 1980, 1989). The method may be used as long-term individual therapy extending over 30 1-hr. periods, or as group therapy, using groups of 20 to 25 subjects for a variable number of 3-hr. sessions, or as bibliotherapy as described above. All those variants have been shown in long-term follow-ups to be significantly successful in preventing cancer and coronary heart disease, when comparing therapeutic with control groups (Eysenck & Grossarth-Maticek, 1989, in press).

Table 4 shows the outcome after 10 years, relating mortality to rated sclerosis in both groups. There is clear evidence that mortality is lowered in the group given therapy; of 53 probands, 33 are still alive in the therapy group, but only 9 in the control group ($p < .001$). Degree of sclerosis is significantly related to mortality ($p < .001$) for all deaths, but therapy has not had any measurable effect on sclerosis, unlike results of our previous study (Grossarth-Maticek, *et al.*, in press).

Discussion and Conclusions

Conclusions emerge from these studies which may have considerable medical and social importance. It would seem that regardless of personality type, taking regular part in sports has a prophylactic effect as far as cancer, coronary heart disease, and other causes of death are concerned; over-all mortality is lowest among persons who are actively engaged in some form of sport. Over-all and particularly for probands of Type 2, the behaviour most likely to lead to death from cancer and coronary heart disease is to discontinue sporting activities for lengthy periods. Intermediate over-all is the condition in which the individual never engages in any sport at all. From the point of view of mortality, youngsters might be advised to take up a sport and continue with it until old age; this is likely to prolong their life expectation significantly, although the degree of improvement may depend on their personality type. Even probands who have given up sport may improve the probability of survival by means of a suitable type of behaviour therapy, requiring only a few hours to administer. In this our results agree well with those of previous studies. All these results should, of course, be regarded as preliminary rather than as final, in view of the relatively small numbers in the various groups. However, the findings are important enough to invite replication on a larger scale.

Our findings are, of course, correlational, and not necessarily causal,

but a causal chain may be involved (Eysenck, 1986, in press). It has been suggested that personality factors involved in Type 1, such as inability to cope with interpersonal stress, may lead to feelings of hopelessness/helplessness and depression; depression leads to increases in cortisol, which in turn are immunodestructive. Sport activity may counteract such a course, although of course direct evidence from immunological assays would be needed to support such a view. As the immune system also plays a role in atherosclerosis, via the action of macrophages, this hypothesis may also extend to our findings concerning coronary heart disease. No stress is put here on these hypotheses, other than as giving suggestions for further research which may validate or invalidate this line of theorising.

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