

ALCOHOL CONSUMPTION AND HEALTH: SYNERGISTIC INTERACTION WITH PERSONALITY¹

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Summary.—In this study, 6,386 males and 5,990 females, with a mean age of 55 years, constituting a random sample, were administered questionnaires by interviewers relating to amount of self-regulation and drinking status. They were then followed up over a 20-yr. period, and health status (living well, chronically ill, or deceased) was ascertained. It was hypothesized that the deleterious effect of alcohol would be worse for those low on self-regulation; that health status would be worse for those in whom *drinking* diminished self-regulation, as compared with those for whom drinking improved self-regulation; and that smoking would have greater effects in lowering health status in those in whom drinking diminished self-regulation than in those in whom drinking improved self-regulation. All predictions were borne out by the data at high statistical significance. The results confirmed findings from an earlier study to the effect that *psychological factors like self-regulation powerfully influence the kind of effects drinking has with respect to health.*

There is considerable agreement on the proposition that *lifestyle* may have a profound influence on health. Much attention has been devoted to aspects of lifestyle such as smoking, drinking, and exercise. The National Cancer Institute (Grenwald & Sandik, 1986) estimated that “life style and environmental factors are related to development of roughly 90% of cancer incidence” (p. 15). Most of this work has been along the lines of *univariate* analysis, when the evidence clearly suggests *multivariate* causation (Eysenck, 1991). The evidence is strong that physical and psychosocial risk factors interact synergistically (multiplicatively, not additively) (Eysenck, 1994b), and if that is true, clearly univariate analyses are not very informative. It is also important to note that, although personality traits have been shown to be correlated with physical risk factors and also constitute risk factors on their own, they are not normally taken into account in epidemiological studies (Eysenck, 1980, 1991).

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The importance of psychological factors in determining the effects of drinking has been illustrated in a previous paper (Grossarth-Maticek & Eysenck, 1991) in which we showed that motivational factors related to personality were influential in producing differential effects of drinking. Probanda who drank to drown their sorrows had a much higher mortality rate than those who drank for pleasure or to celebrate. This paper also showed that, while large amounts of alcohol have negative effects on health, smaller amounts may have positive effects (Gronbach, Deiss, Thornkild, Becker, Mohr, & Jensen, 1995). The same may be true of smoking (Castles, 1994).

In this previous paper, we used tests of personality that identified cancer-prone and coronary heart disease-prone persons who were otherwise healthy, i.e., did not suffer from any serious physical illness. The questionnaires used identify types of coping behaviour under stress that are maladaptive and lead to failure to cope properly with stress. These types of personality were significantly more prone to cancer or coronary heart disease, respectively, and this personal liability interacted with alcohol intake. A third variable was the motivational one. Drinkers were assigned to an S (sorrowful drinkers) or P (pleasure drinkers) group, and effects of this assignment studied. As reported, S drinkers fared much worse than P drinkers, as predicted, with respect to invitality.

In the present study we have relied on an instrument designed to measure a healthy, autonomous, self-regulatory personality. This concept of self-regulation is in some ways similar to Bandura's concept of self-efficacy (Bandura, 1991) or the notion of "hardiness" (Kobasa, Maddi, & Kahn, 1982). The measure consists of 105 questions relating to nonneurotic, self-expressive, self-regulatory, autonomous, successful, integrated types of behaviour and appropriate reactions to stressful situations; with each question are six choices of answers in Likert style (Eysenck, 1994a). The reliability (Cronbach alpha) of the Self-regulation scale is between 0.80 and 0.90 for various samples. (Copies can be obtained from the second author; cf. Footnote 1.)

METHOD

In 1973, 7,630 men and 6,833 women, between the ages 40 and 60 years, resident in Heidelberg, Germany, were approached by interviewers and asked to take part in a scientific investigation of factors relating to health. Choice of respondents was random, based on community registers. Sixteen percent of the men (1,244) and 12% of the women (837) refused to take part, leaving 6,386 men and 5,996 women in all. The mean age of the men was 54.8 yr., that of the women 55.3 yr. Subjects were followed up, and their health status ascertained after 20 years (1973-1993). Mortality was assessed through death certificates and interviews concerning health, aided by doctors' certificates.

Three questionnaires were administered by the interviewer in 1973. (1) The Self-regulation Questionnaire has already been described. Scores on self-regulation were divided into four categories (high, above average, below average, low). Details about the close relation between self-regulation and mortality (cancer, coronary heart disease, and others) are given elsewhere (Grosarth-Maticek & Eysenck, in press). (2) A 20-question inventory queried the effects of drinking on self-regulation; Table 1 shows the questions asked. Underlying this questionnaire was the hypothesis that drinking might alter a person's self-regulation in one of two ways: either it could *improve* self-regulation, or it could *impair* it. To be allocated to the improved group, the drinker had to state at least one positive effect and no negative effects. If a drinker admitted just one negative effect on self-regulation, that person was allocated to the impaired group.

TABLE 1
QUESTIONNAIRE ITEMS FOR STUDY OF EFFECTS OF DRINKING ALCOHOL
ON IMPROVED AND DIMINISHED SELF-REGULATION

a.	Improved self-regulation from alcohol
	1. Relaxes me.
	2. Improves my well-being.
	3. Stimulates me in a positive way.
	4. Has a positive influence on my feelings.
	5. Improves my sex life.
	6. Helps me to converse better with other people.
	7. Improves my mood, e.g., leads to <i>gaiety</i> that makes me feel well.
	8. Intensifies the feeling of having an emotional bond with others.
	9. Improves my self-esteem.
	10. Improves my relationships with other people.
b.	Diminished self-regulation from alcohol
	1. <i>Makes my personal problems and difficulties worse.</i>
	2. <i>Makes me feel even more unwell.</i>
	3. <i>Increases anxiety, insecurity, and other problems in the mind.</i>
	4. <i>Increases my worries/grief and sorrow.</i>
	5. <i>Isolates me from people who see a lot of me.</i>
	6. <i>Inhibits me from doing things which are important to me.</i>
	7. <i>Makes me too aggressive and difficult for others to tolerate.</i>
	8. <i>Intensifies negative recollections and experiences.</i>
	9. <i>Worsens my concentration and memory.</i>
	10. <i>Leads to poor physical health, e.g., sleep disorders, itch, fatigue.</i>
	11. <i>Leads rapidly to drunkenness of considerable duration.</i>

(3) An alcohol consumption questionnaire was used to ascertain the number of grammes of alcohol consumed daily. This was based on pictures shown to the proband, illustrating volume consumed, and type of alcoholic drink consumed. Also ascertained was the number of years alcohol had been

consumed, whether alcohol consumption had been rising or falling over the years, and how regular consumption had been. Table 2 shows the drinking habits of the sample reported in 1973.

TABLE 2
THE SAMPLE: DRINKING HABITS REPORTED IN 1973 ($N = 12,382$)

Alcohol Consumption	
Under 20 gr daily (M 16.5 gr)	4,115
20 gr or more daily (M 31.6 gr) but irregular amounts and intervals	4,806
Too irregular to categorize	35
Stable amounts, 20+ gr daily, 6 times a week, for previous 10 or more weeks	2,075
Abstainers, or almost abstainers, for previous 10 or more years	1,351
Total	12,382

RESULTS

Table 3 gives a breakdown of the data by scores on the Self-regulation Questionnaire, drinking vs abstaining, and mortality. In 1973, the subsamples contained 2,075 drinkers, but of these 82 men and 60 women, a total of 142, had to be discarded because they became abstainers, leaving 1,933 drinkers. Conversely, in 1973 there had been 1,351 abstainers, but of these 91 men and 23 women, 114 in all, became drinkers, leaving 1,237 abstainers. Of the drinkers, 930 were men, 1003 women. Of the abstainers, 651 were men and 568 women. The mean ages of the groups were 54.1 yr. for male drinkers, 55.2 yr. for female drinkers, 55.1 yr. for male abstainers, and 56.1 yr. for female abstainers.

TABLE 3
SELF-REGULATION AND ALCOHOL IN RELATION TO HEALTH AND ILLNESS,
1993 FOLLOW-UP STUDY: DRINKERS AND ABSTAINERS

	Alive & Well	Chronically Ill	Deceased	Total	Self-regulation
Drinkers, stable quantity, regularly, 10+ years ($n = 1933$)					
f	115	183	182	480	1. Bad
%	23.9	38.1	37.9		
f	224	198	115	537	2. More bad than good
%	41.7	36.8	21.4		
f	466	152	45	663	3. More good than bad
%	70.2	22.9	6.7		
f	216	30	7	253	4. Good
%	85.3	11.8	2.7		
f	1021	563	349	1933	Total
%	52.8	29.1	18.0		
Unweighted M , %	55	27	17		

(continued on next page)

TABLE 3 (CONT'D)
 SELF-REGULATION AND ALCOHOL IN RELATION TO HEALTH AND ILLNESS,
 1993 FOLLOW-UP STUDY: DRINKERS AND ABSTAINERS

	Alive & Well	Chronically Ill	Deceased	Total	Self-regulation
Abstainers, 10+ years ($n = 1237$)					
<i>f</i>	102	116	100	318	1. Bad
%	32.2	36.4	31.4		
<i>f</i>	121	89	36	246	2. More bad than good
%	49.1	36.1	14.6		
<i>f</i>	351	113	30	494	3. More good than bad
%	71.0	22.8	6.0		
<i>f</i>	162	13	4	179	4. Good
%	90.5	7.2	2.2		
<i>f</i>	736	331	170	1237	Total
%	59.4	26.7	13.7		
Unweighted <i>M</i> , %	61	25	13		

Before outlining the statistical evaluation, we may perhaps describe the major findings. (1) For the drinkers, self-regulation correlated strongly with being alive and well (positively) and with chronic illness and mortality (negatively). (2) The same is true of abstainers; self-regulation clearly has health-preserving properties. (3) Abstainers do slightly better in each category than drinkers, but the differences are slight and of little practical importance.

The statistical analysis shows the following: (1) The over-all χ^2 is 691.47, with 15 *df*, which gives a $p < .0001$. Clearly, the relations of health with drinking and self-regulation contain eminently significant factors. (2) Comparing drinkers vs abstainers, irrespective of score on self-regulation, gives a χ_2^2 of 16.15 ($p < .001$). Apparently fewer drinkers are alive and well, and more are deceased than expected. On the other hand, more abstainers are alive and well, and fewer are deceased. (3) Within the four "Amount of self-regulation" categories χ_2^2 was 7.02 ($p < .05$) for Level 1, $\chi_2^2 = 6.15$ ($p < .05$) for Level 2, $\chi_2^2 = 2.11$ (ns) for Level 3, and $\chi_2^2 = 2.66$ (ns) for Level 4. Thus the main effect of drinking is limited to poor self-regulators. A more detailed analysis was undertaken to look at the effects of amount of self-regulation (four groups) ($df = 3$) on the three categories of well-being in the drinking and abstaining groups separately. For the drinkers, $\chi_6^2 = 757.67$ ($p < .0001$); for the abstainers, $\chi_6^2 = 243.29$ ($p < .0001$). Clearly there is a strong effect on health of the magnitude of self-regulation scores for both drinkers and abstainers, being more marked for the former. The effect is present at each of the four categories of self-regulation scores. For drinkers, χ_2^2 for the four categories of self-regulation scores (from low to high) are 19.00, 36.21, 433.31, and 311.50 ($ps = .001, .001, .0001, \text{ and } .0001$, respectively). There are clear-cut interaction effects in these data for the drinking group. For low

scorers on self-regulation, fewer individuals are alive and well and more are chronically ill or deceased than expected; for Level 4 or high scorers on self-regulation the opposite is true.

For abstainers, the corresponding values of χ_6^2 for the categories of self-regulation scores are 1.43, 44.95, 337.19, and 203.93, $p = ns, .001, .0001, \text{ and } .0001$, respectively. Again, these are clear-cut interaction effects. As with the drinkers, fewer individuals are alive and well than expected, and more are chronically ill or deceased than otherwise were expected (low scorers on self-regulation). For high scorers on self-regulation, however, more individuals are alive and well, and fewer are chronically ill or deceased than otherwise expected. Thus regardless of whether respondents were drinking or not, the index of self-regulation shows a powerful effect on health, favouring those having high scores.

Table 4 shows results of comparing those regular drinkers whose self-regulation scores were improved by drinking with those whose self-regulation scores were lowered with drinking. Again, groups are differentiated by their original scores on self-regulation; these scores correlated positively with well-being and negatively with chronic illness and mortality. Our main interest, however, is in the comparison of the differential effects of alcohol. Clearly, those whose self-regulation scores were high, compared with those whose self-regulation scores were low, are much more likely to be alive and well and much less likely to be chronically ill or dead. Over-all, 74% of the former group are alive and well against 36% of the latter. Twenty percent of the former group are chronically ill as against 38% of the latter, with mortality of 6% and 26%, respectively. The effect of alcohol on health is very dependent on the way alcohol affects people by either improving or diminishing their scores on self-regulation.

Turning to the statistical analysis, the over-all χ_{15}^2 is 459.83 ($p < .0001$), indicating that there are over-all effects. The comparison of the group with improved scores on self-regulation vs the group with lowered scores irrespective of 1973 self-regulation level, gives a χ_2^2 of 2,187.15 ($p < .0001$). Hence, when use of alcohol is associated with *improved* scores on self-regulation, more are alive and well, and fewer are chronically ill or deceased than would be expected by chance. When use of alcohol accompanies *diminished* scores on self-regulation, fewer are alive and well, and more are chronically ill or deceased than would be expected by chance. This is true for every level of self-regulation scores ($ps < .0001, .0001, .001, \text{ and } .001$ for Levels 1 to 4). Differences are largest for Level 1 and smallest for Level 4. That is not unexpected. The effect is most serious for the least self-regulatory group.

It is interesting to compare the drinkers whose self-regulation scores were improved by use of alcohol with the abstainers in Table 3. Clearly, the former live longer and have less chronic illness than abstainers, while those

TABLE 4
REGULAR DRINKERS OF LONG-STANDING: ALCOHOL-INFLUENCED SELF-REGULATION IN
RELATION TO HEALTH AND ILLNESS: IMPROVED AND DIMINISHED SELF-REGULATION

	Alive & Well	Chronically Ill	Deceased	Total	Self-regulation
Alcohol-improved self-regulation (<i>n</i> = 1933)					
<i>f</i>	95	64	20	179	1. Bad
%	53.0	35.7	11.1		
<i>gr</i>	89	60	65		
<i>f</i>	163	51	19	233	2. More bad than good
%	69.9	21.8	8.1		
<i>gr</i>	88	69	67		
<i>f</i>	361	70	19	450	3. More good than bad
%	80.2	15.5	4.2		
<i>gr</i>	71	70	61		
<i>f</i>	166	12	2	178	4. Good
%	93.2	6.7	1.1		
<i>gr</i>	63	61	59		
<i>f</i>	785	197	60	1042	Total
%	75.3	18.9	5.7		
Unweighted <i>M</i> , %	74	20	6		
Alcohol-diminished self-regulation (<i>n</i> = 891)					
<i>f</i>	20	119	162	301	1. Bad
%	6.6	39.5	53.8		
<i>gr</i>	38	63	85		
<i>f</i>	61	147	96	304	2. More bad than good
%	20.0	48.3	31.5		
<i>gr</i>	40	67	88		
<i>f</i>	105	82	26	213	3. More good than bad
%	49.2	38.4	12.2		
<i>gr</i>	45	65	89		
<i>f</i>	50	18	5	73	4. Good
%	68.4	24.6	6.8		
<i>gr</i>	45	69	89		
<i>f</i>	236	366	289	891	Total
%	26.4	41.0	32.4		
Unweighted <i>M</i> , %	36	38	26		

whose self-regulation scores were diminished by use of alcohol are very much less well off health-wise than the abstainers.

Table 4 also shows the amount of alcohol drunk by the various subgroups. In the group whose improved self-regulation scores were associated with use of alcohol, the higher the daily consumption up to a point, the lower mortality and chronic disease and the greater the percentage of healthy survivors. The opposite is true for those whose drinking was associated with diminished self-regulation scores.

We may finally look at the interaction between alcohol consumption

and smoking. We differentiate between smokers and nonsmokers in terms of ever or never having smoked with any regularity. Table 5 shows the results for drinkers for whom alcohol consumption was associated with improved self-regulation scores vs those for whom the association was with diminished self-regulation scores. Smoking clearly was not related for the former as far as health is concerned, but was related to bad outcomes for the latter. There appears to be here a synergistic interaction effect, much in line with the general finding concerning synergistic interaction effects on physical and psychosocial risk factors for cancer and coronary heart disease (Eysenck, 1994b).

TABLE 5
INTERACTION OF SMOKING AND EFFECTS OF DRINKING ON SELF-REGULATION,
HEALTH, ILLNESS, AND MORTALITY IN RELATION TO SMOKING IN DRINKERS

		Alive & Well	Chronically Ill	Deceased	Total
Alcohol-improved self-regulation ($n = 1042$)					
Smoker	<i>f</i>	409	90	29	528
	%	39.2	8.6	2.7	50.6
Nonsmoker	<i>f</i>	376	107	31	514
	%	36.0	10.2	2.9	49.3
Alcohol-diminished self-regulation ($n = 891$)					
Smoker	<i>f</i>	16	204	234	454
	%	0.5	22.8	26.2	50.9
Nonsmoker	<i>f</i>	220	162	55	437
	%	24.6	18.1	6.1	49.0

Table 6 shows the interaction of smoking and the effects of drinking on self-regulation scores. The over-all χ^2 is 294.69 ($p < .001$). The comparison of just smokers vs nonsmokers, irrespective of use of alcohol and scores on self-regulation, gives a χ^2 of 119.06 ($p < .0001$). Smoking, as expected, is associated with greater chronic illness and mortality. Alcohol consumption is more often associated with improved scores on self-regulation than with diminished scores ($\chi^2 = 11.80$, $p < .001$). However, there is an important interaction. Among smokers, when use of alcohol is associated with improved scores on self-regulation, more smokers are alive and well than expected, while, when use of alcohol is associated with diminished scores, more smokers are deceased than expected ($\chi^2 = 565.09$, $p < .00001$). Among nonsmokers, there is the same effect but less strong ($\chi^2 = 52.95$, $p < .001$). The significant difference may suggest that reasons for smoking are relevant to health effects of smoking in the same way that reasons for drinking are relevant to health effects of drinking (Grossarth-Maticek & Eysenck, 1991). This would be in good accord with the Eysenck and the Tomkins models of smoking, which differentiate smokers with positive affect from those with negative affect (Spielberger, 1986). It is not unreasonable to expect people who drink

for positive affect also to smoke for positive affect, and for those who drink to counter negative affect to smoke for the same reason.

When use of alcohol is associated with improved self-regulation scores, there is no significant difference in health rates for smokers vs nonsmokers ($\chi_2^2 = 2.72$, ns). However, when use of alcohol is associated with diminished scores on self-regulation, fewer smokers are alive and well, and more are deceased than expected by chance. Similarly, more nonsmokers are alive and well ($\chi_2^2 = 291.88$, $p < .0001$). Clearly the interaction is significant and important.

TABLE 6
INTERACTION OF SMOKING AND EFFECTS OF DRINKING ON
SELF-REGULATION IN RELATION TO HEALTH OF DRINKERS

Drinkers		Alive & Well	Chronically Ill	Deceased	Total
Smoker	<i>f</i>	425	294	263	982
	%	21.9	15.2	13.6	50.8
Nonsmoker	<i>f</i>	596	269	86	951
	%	30.8	13.9	4.4	49.1

Over-all $\chi_2^2 = 119.16$, $p < .0001$

Collapsing the data across three levels of health, the over-all $\chi_2^2 = 119.16$ ($p < .0001$), showing an advantage for nonsmokers. In the group for whom use of alcohol was associated with *improved* scores on self-regulation, $\chi_2^2 = 2.72$ (ns), showing no advantage for either smokers or nonsmokers. Hence, for this group smoking has no adverse effect on health or well-being. For the group whose use of alcohol is associated with *diminished* scores on self-regulation, however, $\chi_2^2 = 291.88$ ($p < .0001$), showing that for this group smoking is directly related to chronic ill health and death. Nonsmokers have better than expected well-being.

Table 7 shows the incidence of alcohol-related problems in the group of persons with diminished vs improved self-regulation. In each case, values of chi-square with 1 *df* are given as well as *p* values. The four levels of self-regulation scores are separated, with the lowest scores at the top and the highest scores at the bottom. The number of cases in the highest scoring group is too small to apply statistical tests in a meaningful way. Wherever applicable, Yates' correction for continuity has been applied to compensate for effects due to small cell sizes. The analyses indicate that, in general, alcohol-related problems are significantly higher in frequency and intensity in individuals for whom use of alcohol is associated with diminished self-regulation scores as compared with those for whom use of alcohol is associated with improved scores.

Table 8 summarizes results from Table 7 for the four self-regulation

TABLE 7
ALCOHOL-RELATED PROBLEMS OF DRINKERS FOR WHICH ALCOHOL-IMPROVED
OR -DIMINISHED SELF-REGULATION IS RELATED TO SELF-REGULATION

	Improved		Diminished		Self-regulation	
	<i>f</i>	%	<i>f</i>	%	χ_1^2	<i>p</i>
Low Self-regulation					1.6-2.5	
Alcohol dependency	18	10.0	179	59.4	113.24	<.0001
	<i>n</i> , 179		<i>n</i> , 301			
Alcohol-related therapy	4	2.2	86	28.5	49.38	<.001
	137 gr/day*		87 gr/day			
Unemployment	16	8.9	141	46.8	73.28	<.001
Disorders	15	8.3	159	52.8	95.95	<.001
Social/Marital Problems	17	9.4	167	55.4	100.42	<.001
Lower Than Average Self-regulation					2.6-3.5	
Alcohol dependency	17	7.2	129	42.4	82.27	<.001
	<i>n</i> , 233		<i>n</i> , 304			
Alcohol-related therapy	3	1.2	271	23.3	403.94	<.0001
	148 gr/day*		105 gr/day			
Unemployment	9	3.8	126	41.4	99.02	<.001
Disorders	7	3.0	137	45.0	118.91	<.001
Social/Marital Problems	10	4.2	144	47.3	119.67	<.001
Higher Than Average Self-regulation					3.6-4.5	
Alcohol dependency	5	1.1	21	9.8	29.38	<.001
	<i>n</i> , 450		<i>n</i> , 213			
Alcohol-related therapy	2	0.4	13	6.1	11.83	<.001
	162 gr/day*		118 gr/day			
Unemployment	3	0.6*	18	8.4	26.06	<.001
Disorders	3	0.6*	10	4.6	10.18	<.01
Social/Marital Problems	4	0.8*	17	7.9	21.43	<.001
High Self-regulation					4.6	
Alcohol dependency	1	0.5*	3	4.1	Cannot be calculated, sample too small	
	<i>n</i> , 178		<i>n</i> , 73			
Alcohol-related therapy	1	0.5	3	4.1		
	178 gr/day*		129 gr/day			
Unemployment	1	0.5*	2	2.7		
Disorders	0		4	5.4		
Social/Marital Problems	1	0.5*	2	2.7		

*Yates correction.

groups combined. All values of chi-square are statistically significant. Clearly the *reaction* of a person to the ingestion of alcohol has a very powerful effect on the health consequences of the ingestion. Those for whom use of alcohol is associated with diminished scores on self-regulation show more alcohol dependency, more alcohol-related unemployment, more alcohol-related disorders, and more alcohol-related social and marital problems than those for whom use of alcohol is associated with improved scores on self-regulation.

TABLE 8
ALCOHOL-RELATED PROBLEMS OF DRINKERS FOR WHOM ALCOHOL IMPROVED OR DIMINISHED
SELF-REGULATION: SELF-REPORTS AND REPORTS FROM RELATED PERSONS

		Improved	Diminished	Total	Self-regulation	
					χ_1^2	<i>p</i>
Self-reports						
Alcohol Dependency	<i>f</i>	41	332	373	342.56	< .0001
	%	3.9	37.6	19.4		
Alcohol-related Therapy	<i>f</i>	10	173	183	190.90	< .0001
	%	0.9	19.4	9.4		
Unemployment	<i>f</i>	29	287	316	304.15	< .0001
	%	2.7	32.2	16.3		
Disorders	<i>f</i>	25	310	335	351.75	< .0001
	%	2.3	34.7	17.3		
Social/Marital Problems	<i>f</i>	32	330	362	364.07	< .0001
	%	3.0	37.0	18.7		
Reports From Related Persons						
Alcohol Dependency	<i>f</i>	41	346	387	352.14	< .0001
	%	4.3	41.2	21.8		
Alcohol-related Therapy	<i>f</i>	9	168	177	178.88	< .0001
	%	0.9	20.0	9.9		
Unemployment	<i>f</i>	20	296	316	300.82	< .0001
	%	2.1	35.2	17.8		
Disorders	<i>f</i>	24	319	343	356.40	< .0001
	%	2.5	38.0	19.3		
Social/Marital Problems	<i>f</i>	61	498	559	571.95	< .0001
	%	6.5	59.3	31.5		
<i>n</i>		935	839	1774		
Consumption, gr/day		165	120			

DISCUSSION

There is much evidence to show that psychological factors (stress, personality, and coping behaviours) interact with physical factors (smoking, drinking, and heredity) in a synergistic manner to produce different levels of health and well-being. In this study we have used the concept of self-regulation, which may be regarded as the opposite of such concepts as neuroticism, to mark a healthy type of personality and have attempted to investigate the way self-regulation interacts with drinking (and to a less extent with smoking) in the determination of differential levels of health. We studied, in addition, the effects of drinking on self-regulation scores and the health consequences of the interaction, i.e., the differences in health status produced by drinking, increasing or diminishing self-regulation.

The predicted effects of personality on the interaction of drinking and health were found. Those who abstain have better health than those who drink, but this effect is weaker for groups who have high self-regulation scores and stronger for groups with low scores on self-regulation. For both

drinkers and abstainers, scores on self-regulation correlate highly with well-being and negatively with chronic ill health and mortality. Self-regulation and drinking interact to produce major differences in health status, and no analysis of drinking alone (univariate analysis) can depict clearly the complexity of the total interaction.

For those in whom use of alcohol is associated with *improved* scores on self-regulation (improvers), there is little effect on health of alcohol, but in those with diminished scores on self-regulation, use of alcohol has a strong, deleterious effect. In fact, those with improved scores compare well health-wise with abstainers; clearly, drinking is mainly a problem in groups with low self-regulation or in those for whom drinking is associated with diminished scores on self-regulation.

The effects of smoking show a similar effect. It has little effect on persons with *improved* scores on self-regulation but a strongly deleterious effect on those whose scores *diminish*. This agrees well with our finding that the effects of smoking on health are synergistic with personality qualities similar to self-regulation (Eysenck, 1994b). Like drinking, smoking has deleterious effects largely on certain types of persons characterized by low scores on self-regulation. Univariate statistics disregarding such interactions can seriously misrepresent the actual status of the problem.

The consequences of drinking, i.e., whether drinking is associated with increases or decreases in self-regulation scores, also influences such consequences of drinking as alcohol dependence, related therapy, unemployment, disorders, and social and marital problems, all these problems being much more serious for those who show diminished than improved self-regulation. It seems clear that experimental and observational studies of the effects of alcohol should be designed carefully to include measures of *personality* as essential parts of the investigation. It is no longer possible to assume that effects are equivalent for all participants or that simple averages can do justice to the actual state of affairs. Equal doses of alcohol can have opposite effects on the health status of people according to their personalities. This is the major conclusion to be drawn from our investigation. Clearly, what is needed is a model of drinking behaviour, related to motivational factors, similar to that provided for smoking by Tomkins (1968). It seems that such a model would share many similarities with the Tomkins model.

It is possible that the exclusion of drinkers who become abstainers might have introduced a bias into the comparisons by understating risks associated with drinking. It may be that some portion of former drinkers decided to quit drinking after prolonged periods of very heavy drinking or as a consequence of affected health; however, the number of omissions was very small. It is unlikely that more than a fraction of those who became abstainers would have done so because of grossly excessive behaviour; such people

are not regarded as good candidates for cures. More doubtful is our decision not to discriminate between men and women, as women process alcohol somewhat differently from men. Proportions between the sexes being fairly equal in all the groups, we used total groups as splitting the sexes would have reduced numbers unduly. In further studies we propose to look at sex differences more specifically.

It should be noted that in previous studies we suffered a sizeable loss of subjects on follow-up. To avoid this in the present study, each subject was asked on enrollment to give us addresses of *five* references who could be contacted to discover any change of address, including relatives, friends, workplace, etc. This enabled us to locate every surviving member of the group, and we recommend this method to anyone contemplating research involving large-scale follow-up.

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