

Association of Specific Behavior Pattern in Women with Blood and Cardiovascular Findings

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A SPECIFIC overt behavior pattern appeared to us to be a common denominator of clinical coronary heart disease, since for some years we had observed it to be almost invariably present in young and middle-aged men already exhibiting clinical disease. This overt behavior pattern, which we have termed "type A"¹ appeared to us to result from a combination of certain personality traits such as excessive competitive "drive," persistent desire for recognition, advancement and achievement, and persistent inclination for multiple vocational and avocational involvements, on the one hand, and of chronic immersion in "deadlines," on the other hand. The interplay of these endogenous and environmental factors was observed to impart a chronic sense of time urgency, with the propensity or need habitually to accelerate the rate of execution of many if not all physical and mental functions. The key area of harassment in such an individual usually is a seeming paucity of time itself. This "type A" behavior pattern obviously is different from and should not be confused with fear, anxiety or worry states, simple neurosis or similar emotional stresses, as has so often been done in recent medical literature.

Acting on this possible lead we studied² a group of accountants before, during, and after isolated exposures to occupational "deadlines" that appeared to induce this behavioral complex acutely in many of them, and found that the latter often exhibited marked increases of serum cholesterol and acceleration of blood coagulation at such times, but independent of

changes in diet, weight, or physical activity. We therefore studied¹ groups of men selected for us by lay selectors solely on the basis of their chronic exhibition of the "type A" behavior pattern or a converse "type B" behavior pattern. It was found that men possessing overt behavior pattern "A" also exhibited much higher serum cholesterol levels, more rapid blood clotting, higher incidence of arcus senilis, and a seven-fold higher incidence of coronary heart disease than did either paired subjects exhibiting frank anxiety states, although again the dietary, drinking, smoking, and exercise habits of the three groups were comparable.

In view of these striking differences found in men randomly selected by lay selectors solely on the basis of different but clear-cut overt behavior patterns, it appeared to us of importance to determine whether the possession of behavior pattern "A" would also be associated with higher blood cholesterol and increased incidence of clinical coronary disease in women, such as occurs in this sex when vascular damage and atherogenesis are accelerated by hypertension or diabetes.

Methods of Study

Selection of Two Study Groups

In the selection of subjects exhibiting overt behavior pattern (group A), the aid of six female executives exhibiting the same behavior pattern was enlisted. The characteristics of behavior pattern A were carefully explained to them and they were asked to choose apparently healthy 30- to 59-year-old women, to their knowledge free of clinical cardiac disease, and chosen *solely* on the basis of the exhibition of the various facets of overt behavior pattern A: (1) sustained, aggressive "drive" for achievement, advancement, and recognition, (2) competitiveness and the desire to win, (3) habitual immersion in multiple vocational and avocational involvements subject to the time pressures of "deadlines," (4) extraordinary mental and physical alertness, and (5) the habitual propensity to

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Table 1*Job Classification and Marital Status of 257 Female Subjects*

	Overt behavior pattern	
	Pattern A	Pattern B
Total Number*	125	132
% Married	64	84
% Working	97	36
% Married and working	62	20
Work Classification		
Housewife	4	84
Professional	5	0
Executive	84†	1
“White collar”	32	47‡

*Nuns included.

†Included 19 nuns.

‡Includes 20 nuns.

accelerate their pace of execution of most physical and mental functions.

These lay selectors accordingly chose 112 subjects (group A). Each received a letter describing the study and we were gratified that 106 of their selected women accepted the invitation to participate, the remaining six declining on the basis of recent illness, travel, or lack of time. Four of the 106 women (table 1) were not gainfully employed, and there were five attorneys and physicians, 65 business, political, or civic executives, and 32 white collar workers. In order to ensure the inclusion of subjects that did not consume either alcohol or cigarettes, there was an additional 19 nuns of an admittedly forceful order of sisters. Each nun was selected by the Mother Superior who was oriented concerning the characteristics of behavior pattern A.

Upon completing the study of the total 125 group A subjects, the nature of the study was explained to five other lay selectors who were asked to select 30- to 59-year-old women exhibiting the converse behavior pattern B (group B), i.e., women exhibiting placidity, relative absence of drive for advancement and recognition, aggressiveness, desire to compete, ambitiousness, involvement in occupational deadlines, sense of time urgency or the propensity to accelerate speech, mental and physical functions. These lay selectors, chosen by us because of their own exhibition of the behavior pattern B, accordingly selected 139 subjects. Only three of these declined our invitation to participate, but an additional four later were rejected because of medications that might affect the results. Eighty-four of the remaining 132 group B subjects (table 1) were housewives not gainfully employed, and there was one executive secretary and 27 white collar workers. The remaining 20 subjects

were obviously placid nuns engaged solely in teaching elementary school, and were selected by the Mother Superior of a separate order of sisters, after orienting her concerning the facets of behavior pattern B.

It is important to emphasize again that the subjects herein studied were selectees, chosen for us by lay selectors *solely* on the basis of their opposing behavior patterns.

The Personal Interview

Each subject carefully completed an advance questionnaire furnishing detailed information about her habitus, catamenia, marital history and parental history of clinical coronary heart disease, her personal medical history, ingestion of drugs, vocational and avocational positions, responsibilities and time pressures, and her habits of smoking, drinking, eating, dietary restrictions, sleep, walking, and other physical exertion. Each of these factors was personally clarified and verified during a subsequent interview with one of us. At the personal interview the degree of development of behavior pattern A or B, respectively, was assessed and recorded by one of us prior to any subsequent procedures. In order to avoid any bias on the part of the authors, all of the subjects were included in the respective groups for which they had been selected by the lay selectors. However, some were adjudged by us at the outset, from the personal interview, to exhibit an incompletely developed behavior pattern A or B, respectively.

Survey of Dietary, Alcohol, and Smoking Habits

Each subject received personal instruction in the diary system which we previously found so successful,¹⁻³ subsequently recording on a special form the complete consumption of food, alcohol, and cigarettes daily for 7 days, during a week believed characteristic for each subject. Code numbers were used to provide anonymity, thereby avoiding possible reluctance to report all consumption of alcohol, cigarettes, and snacks. The diets were calculated by the chief dietitian of Mount Zion Hospital and Medical Center (Evelyn Piercy, B.S.), who was not informed of the subjects' identity. In about 5 per cent of each group the diaries were either lacking or were not calculated because they failed to exhibit recording of all meals or carefully detailed measurements of portions ingested, nature of sauces or gravies, etc.

Clinical and Laboratory Studies

Following the personal interview and assessment of the completeness of the behavior pattern, each subject was bled once by one of us at 9:00 a.m. to 11:00 a.m. by a two-syringe technic, the first sample being used for duplicate determinations of total serum cholesterol,⁴ and of the cholesterol con-

Table 2

Summary of Findings in All 257 Female Subjects

	Overt behavior pattern type			
	Premenopausal subjects		Postmenopausal subjects	
	Pattern A	Pattern B	Pattern A	Pattern B
No. of subjects*	82	110	43	22
Average age (years)	41	38	53	52
Average height (inches)	65.1	64.6	64.3	64.6
Average weight (lbs.)	133	129	139	144
% Married	66	86	49	73
% Parental history of coronary disease	30.4	32.0	23.0	27.0
<i>Catamenia:</i>				
Average age, menarche (years)	13.1	13.2	13.0	12.9
Average duration menses (days)	4.7	4.7	4.6	4.8
% Irregular menses	8.5	9.0	7.0	27.0
Average age at menopause (years)	—	—	46.6	46.5
<i>Smoking:</i>				
% Smokers	55	43	42	9
% Smoking > 20 daily	35	15	19	0
<i>Exercise:</i>				
% Regular exercise	46	65	30	32
Average no. hours/week	2.3	4.1	2.1	4.0
<i>Alcohol:</i>				
% Drinkers	62	54	40	27
Average calories/day	300	135	97	107
<i>Diet (calories):</i>				
Total calories	1772	1848	1746	1694
Protein	299	266	292	271
Carbohydrate	656	761	709	722
Total fats	817	821	745	701
Animal fats	582	535	521	441
Total fat, % of diet	46.2	44.4	42.6	41.4
<i>Clinical findings:</i>				
Average coag. time (min.)	6.70 ± 0.16†	7.35 ± 0.18	6.75 ± 0.18	6.86 ± 0.21
Average serum cholest. (mg./100 ml.)	272 ± 3.7†	214 ± 4.1	300 ± 5.2	249 ± 5.9
% Arcus senilis	23.1	4.5	55.8	22.7
% Diastolic hypertension	24.3	8.2	34.8	4.5
% Clinical coronary heart disease	9.8	2.7	37.2	9.0

*Nuns included.

†Standard error of the mean.

tent or α - and β -lipoproteins separated by filter paper electrophoresis,⁵ and the second for determination of blood coagulation time, according to our previously described method.² However, the lipoprotein cholesterol content was determined only in 34 group A and 43 group B premenopausal women. These determinations were performed by the same chemists and technicians, respectively, using code numbers for anonymity. In order to avoid the lipid fluctuations of the menstrual cycle,⁶ all premenopausal women were bled during the first week following a menstrual period. Prior to venipuncture, the blood pressure was carefully obtained by the author not engaged in interviewing

the subjects. The final of several determinations was recorded, and, if elevated, further multiple readings were obtained in order to differentiate sustained from labile elevations. Diastolic hypertension was considered to be present if the diastolic pressure persistently exceeded 95 mm. Hg. The possible presence of arcus senilis was then determined by meticulous gross inspection of both eyes, using frontal and lateral flashlight illumination.

A standard 12-lead electrocardiogram then was obtained. These were interpreted "blind," with use of code numbers by an electrocardiographer not involved in the study (Dr. Herman Uhley, Depart-

ment of Medicine and Electrocardiography, Mount Zion Hospital and Medical Center). No attempt was made to record the frequency of minor, non-specific abnormalities of contour or rhythm in view of the lack of their specificity with regard to indicating the presence of coronary disease; if abnormal, they were considered by the electrocardiographer to be diagnostic of ischemic heart disease only if the tracing exhibited a diagnostic pattern of healed myocardial infarction or characteristically abnormal T waves not ascribable to hypertrophy, conduction defects, or other abnormal cardiac or known extracardiac causes.

Finally, each subject was closely questioned about possible heart disease of any cause and specifically for a possible history of myocardial infarction or angina pectoris. The former diagnosis was not accepted unless verified by the electrocardiogram, and the latter was not entertained unless the subject described classical acute episodes of squeezing substernal pain, with or without radiation, precipitated by exercise or acute emotional upset, and relieved readily by rest or nitroglycerin or both and unless the diagnosis was accepted by both authors from independent questioning.

Because of the long-suspected influence of the menopause upon coronary morbidity in women, the two groups of subjects have been subdivided on the basis of this factor for purposes of presentation of the data.

Results

Accuracy of the Assessments of the Behavior Patterns by the Lay Selectors

As shown in table 1, 106 lay subjects were selected for us as exhibiting behavior pattern A. Although none of them were assessed by us during their personal interview as exhibiting the converse pattern (i.e., behavior pattern B), we believed that 56 of these 106 subjects exhibited an incompletely developed form of behavior pattern A.¹ Similarly, of the 112 lay subjects selected for us as exhibiting behavior pattern B, we ourselves considered 25 of these as exhibiting an incompletely developed form of pattern B. In view of the fact, however, that the incompletely developed forms of each behavior pattern resembled their respective completely developed forms far more than they did each other, we have presented below the data of each group as it was chosen for us by our selectors.

The assessment by the Mother Superiors of the 19 nuns exhibiting behavior pattern A and of the 20 nuns exhibiting pattern B ap-

peared to us to be accurate with one exception. Whether such agreement was due to a better comprehension by the Mother Superiors of the two behavior patterns or to necessarily more intimate knowledge of their subordinates, we do not know.

Marital and Employment Status

As can be seen in table 1, 97 per cent of group A women and 36 per cent of group B women worked outside of their homes. The larger percentage of working women in group A was due, we believe, to the fact that some of the facets making up this behavior pattern (e.g., deadlines, competition, etc.) are most often found in the commercial or industrial phases of community living. It can also be noted in table 1 that 64 per cent of group A and 84 per cent of group B women were married, and that more than three times as many women in group A (62 per cent) were both married and working than in group B (20 per cent).

The Premenopausal Subjects

Age, Height, Weight, Catamenia, and Parental History of Coronary Disease

One hundred ninety-two women (including the nuns) were still menstruating (table 2). Eighty-two of these had been assessed for us by the lay selectors as exhibiting behavior pattern A (group A) and 110 as exhibiting pattern B (group B).

The average age of the group A women was 41 years and that of group B women, 38 years. Their average heights and weights (table 2) were approximately the same, as was their incidence of parental coronary heart disease. Similarly, no difference was found in their menstrual histories.

Smoking, Exercise, Sleep and Drinking Habits

There were more women in group A (55 per cent) than in group B (43 per cent) that smoked and more group A women (35 per cent) smoked over one package of cigarettes daily than in group B (15 per cent).

More women in group B (65 per cent) than in group A (46 per cent) regularly exercised and devoted more time weekly to this. More group A women performed regular morning

bedside calisthenics and more group B women did gardening activities. It is doubtful that the recorded differences are significant, however, since in no instance could any subject in this study be said ever to indulge in even moderately heavy physical activity. There were no significant differences in sleep patterns.

Sixty-two per cent of group A and 54 per cent of group B women ingested alcoholic beverages, but the average daily consumption of alcoholic calories was considerably greater among the former (table 2), particularly in the younger age groups. This was found due to the propensity of many of the female executives of group A to have one or more cocktails at their frequent "business" lunches.

Dietary Habits

As can be noted in table 2, there were no significant group differences in average daily intake of total calories, proteins, carbohydrates, total or animal fats, or the percentages of the total caloric intakes composed of fats. Although the diets were carefully recorded and calculated, it is doubtful whether the minimal noted differences are significant.

Blood Coagulation, Serum Cholesterol, and Lipoprotein Cholesterol

The blood coagulation time averaged 6.70 minutes in group A women compared to 7.35 minutes in group B. It is possible that these differences are even more significant in view of the known effect of anxiety on accelerating blood coagulation time, since far more women of group B than group A exhibited excitement and anxiety about the studies. This was probably due to the fact that many more group A women were accustomed to having annual medical examinations at their own behest as well as in connection with their employment.

Highly significant differences were noted in the serum cholesterol levels (table 2). Thus, the serum cholesterol averaged 272 mg./100 ml. in group A women, compared to 214 mg./100 ml. in group B women. These differences were even more striking in comparing those subjects adjudged by us at the outset to exhibit the completely developed behavior patterns, averaging 281 mg./100 ml. (S.E. Mean:

± 5.3) in 45 subjects adjudged by us to exhibit all facets of behavior pattern A, compared to 211 mg./100 ml. (S.E. Mean: ± 3.3) in the 91 subjects we believed exhibited completely developed pattern B. There were no differences found in the lipoprotein distribution of the total serum cholesterol, the α/β lipoprotein cholesterol content averaging 27.5/72.5 per cent in group A subjects and 28.1/71.9 per cent in group B subjects.

Clinical Findings

Arcus senilis was observed in 23.1 per cent of group A women compared to 4.5 per cent of group B women (table 2). Similarly, a much higher incidence of diastolic hypertension was found in group A (24.3 per cent) than in group B (8.2 per cent) women. Clinical coronary heart disease was detected in eight group A women (9.8 per cent) compared to three group B women (2.7 per cent). The diagnosis was made in six of the eight group A women and in all of the group B women from the electrocardiographic findings, a clear-cut history of angina pectoris being obtained in the other two women of group A, but in none of the group B women.

The Postmenopausal Subjects

Age, Height, Weight, Catamenia, and Parental History of Coronary Disease

Sixty-five women were postmenopausal (table 2), of which 43 had been assessed for us by the lay selectors as exhibiting behavior pattern A and 22, pattern B.

The average age of the group A women was 53 years and that of group B women, 52 years. There were no significant differences of average height, weight, catamenia, or average age at menopause (table 2). The latter was influenced by its early occurrence after hysterectomy in some subjects of each group.

Smoking, Exercise, Sleep, and Drinking Habits

In table 2, it can be seen that more of the women in group A (42 per cent) than in group B (9 per cent) smoked and only certain group A (19 per cent) women smoked over 20 cigarettes daily. There were no differences in habits of exercise or sleep. More women in group A (40 per cent) consumed alcoholic

Table 3

Summary of Findings in Two Groups of Nuns

	Overt behavior pattern type			
	Premenopausal subjects		Postmenopausal subjects	
	Pattern A	Pattern B	Pattern A	Pattern B
No. of subjects	9	14	11	5
Average age (years)	42	40	55	46
Average height (inches)	67.0	65.9	64.0	65.4
Average weight (lbs.)	151	140	147	143
% Parental history of clinical coronary disease	11	28	36	40
<i>Catamenia:</i>				
Average age, menarche (years)	13.1	12.7	13.1	13.8
Average duration of menses (days)	4.1	4.4	4.0	4.2
% Irregular menses	0	0	0	20
Average age at menopause (years)	—	—	47	38
<i>Diet (calories):</i>				
Total calories	1703	1593	1683	1504
Protein	270	240	271	219
Carbohydrate	736	715	757	696
Total fats	697	638	655	589
Animal fats	503	458	461	405
Total fats, % of diet	41.5	40.2	39.3	38.7
<i>Clinical findings:</i>				
% Arcus senilis	11.0	0	36.4	20.0
% Diastolic hypertension	22.0	21.4	36.4	0
Average coagulation time (min.)	6.9	6.4	6.4	6.2
Average serum cholest. (mg./100 ml.)	266 ± 8.2*	204 ± 8.6	305 ± 14.1	269 ± 8.9
% Clinical coronary heart disease	33.0	7.1	54.5	0

†Standard error of the mean.

beverages than in group B (27 per cent), but the average daily intake of alcoholic calories by the group A women was slightly less (table 2).

Diet

The average intake of calories and their distribution were very similar in the two groups (table 2), as was the percentage of the total calories derived from total fats and animal fats.

Serum Cholesterol and Blood Coagulation Time

As in the premenopausal subjects, there were highly significant differences of average serum cholesterol levels, which averaged 300 mg./100 ml. in group A women, compared to 249 mg./100 ml. in group B women. If only subjects were considered that were adjudged by us at the outset to exhibit the completely developed behavior patterns A and B, respectively, the average serum cholesterol levels were 318 mg./100 ml. (S.E. Mean: ±8.8) in

24 group A women and 247 mg./100 ml. (S.E. Mean: ±10.0) in 16 group B women. On the other hand, there were no significant differences of average blood coagulation time (table 2).

Clinical Findings

Arcus senilis was observed in 55.8 per cent of group A women compared to 22.7 per cent of group B women (table 2). Similarly, a much higher incidence of diastolic hypertension was observed in group A (34.8 per cent) than in group B (4.5 per cent). A systolic blood pressure persistently exceeding 150 mm. Hg also was found in 37 per cent of group A compared to only 14 per cent of group B women. Clinical coronary heart disease was found in 16 group A women (37.2 per cent) compared to two group B women (9 per cent). The diagnosis was made from the electrocardiographic findings in 10 of the 16 group A and all of the group B women, a history of myocardial infarction being obtained in two

group A women and of angina pectoris in the remaining four group A women.

The Findings in Two Groups of Nuns

The findings in the two groups of nuns (table 3) were of particular interest to us despite their small numbers, since none of the subjects ever consumed alcoholic beverages or smoked and none indulged in physical activity other than walking. Each nun in group A (convent A) was selected by her Mother Superior on the basis of her exhibition of pattern A personality traits, and because she was simultaneously both teaching and an executive at a parochial college, an administrative executive of her Order, engaged in one or more community activities and admittedly subject to chronic harassment from paucity of time per se as a result of her multiple vocational and avocational involvements. The nuns of group B (convent B) had been selected by their Mother Superior because of the total absence of all of the above factors, being engaged vocationally only in teaching in an elementary grade school, in addition to her religious functions.

The Premenopausal Nuns

The average age was 42 years in nine group A nuns and 40 years in 14 group B nuns. The nuns of group A were slightly taller and heavier, but had a small incidence of parental coronary heart disease (table 3). The dietary intakes of calories and various food categories were slightly greater in group A nuns, but were not significant when calculated in terms of body surface area. A similar percentage of the diet was derived from fats in both groups. Arcus senilis was observed only in group A nuns (11 per cent). A tendency to rapid blood coagulation was observed in almost all the nuns of both groups. As in the lay subjects, there were striking differences of serum cholesterol levels, which averaged 266 mg./100 ml. in group A and 204 mg./100 ml. in group B. Clinical coronary heart disease was found in three nuns (33 per cent) of group A compared to one nun (7.1 per cent) of group B, the diagnosis being made from electrocardiographic findings in all nuns.

The Postmenopausal Nuns

The average age of 11 group A postmenopausal nuns was 55 years, compared to 46 years in five group B nuns. The latter's earlier age was ascribable to the earlier surgically induced menopause of three of the nuns of this group. As can be noted in table 3, there were no differences of height, weight, or parental incidence of clinical coronary disease. The average age of the women at the time of their menopause was 47 years in group A and 38 years in group B. Only minor differences were noted in the diets of the two groups (table 3).

Arcus senilis was observed in 36.4 per cent of group A, compared to 20 per cent of group B nuns, and diastolic hypertension was found only in group A nuns (36.4 per cent). There were no differences of average blood coagulation time, but significant differences again were noted in serum cholesterol levels, which averaged 305 mg./100 ml. in group A and 269 mg./100 ml. in group B. Clinical coronary heart disease was found in six group A nuns (54.5 per cent), the diagnosis being made from the electrocardiographic findings in all but one nun from whom a history of angina pectoris was obtained. Clinical coronary disease could not be detected in any of the five group B nuns.

Analysis of Subjects with Clinical Coronary Heart Disease

Inspection of tables 2 and 3 indicates that clinical disease was found about four times as frequently in both the premenopausal and postmenopausal women of group A than in group B. There were eight additional instances where markedly slurred, notched, and broadened ventricular complexes with abnormal T waves were found in the electrocardiograms, but not considered diagnostic of ischemic heart disease. It is of interest, however, that arcus senilis was present in three of them and that seven of these eight tracings were obtained from women in group A.

When the 24 cases of clinical coronary heart disease in group A and the five in group B were more closely studied (table 4), it was found that in addition to the presence of pat-

Table 4
Comparative Findings in Subjects with and without Clinical Coronary Heart Disease

	Overt behavior pattern type				All subjects	
	Pattern A		Pattern B		With heart dis.	Without heart dis.
	With heart dis.	Without heart dis.	With heart dis.	Without heart dis.		
No. of subjects	24	101	5	127	29	228
Average age (years)	48.2	44.2	45.0	40.0	47.7	42.0
Average height (inches)	64.3	65.1	63.4	64.7	64.2	64.9
Average weight (lbs.)	135	137	130	132	134	134
% Obese	16	7	0	5	14	6
% Parental history	33	29	0	30	28	29
<i>Catamenia:</i>						
Average age, menarche (years)	13.3	13.1	13.6	13.0	13.4	13.0
% Irregular menses	8	10	20	12	10	11
% Postmenopausal	67	27	40	16	62	21
Average age at menopause (years)	46.0	47.0	49.0	26.0	48.0	46.5
<i>Diet (calories):</i>						
Total calories	1671	1780	1710	1831	1678	1807
Total fats	720	800	700	802	716	801
Animal fats	466	580	460	518	464	546
% Regular exercise	28	37	65	65		
Sleep, average hrs./night	7.5	7.5	8.0	7.8	7.6	7.7
<i>Smoking:</i>						
% Smokers	42	52	20	39	38	45
% Smoking > 20 daily	13	23	20	9	14	15
<i>Alcohol:</i>						
% Drinkers	21	70	60	53	24	60
Average calories/day	157	258	192	129	170	195
<i>Clinical findings:</i>						
% Diastolic hypertension	41	24	0	8	34	15
% Arcus senilis	58	29	20	7	52	17
Average coag. time (min.)	6.6	6.7	6.8	7.2	6.7	6.9
Average serum cholest. (mg./100 ml.)	296	277	217	220	283 ± 10.9*	243 ± 3.3
<i>Ratio:</i>						
No. of pattern A						
No. of pattern B	—	—	—	—	4.8	0.8

*Standard error of the mean.

tern A in the great majority of them (83 per cent) there was also (table 4) an increased incidence of menopause (300 per cent), diastolic hypertension (227 per cent), obesity (233 per cent), and arcus senilis (300 per cent) as compared to the remaining subjects of both groups A and B who appeared free of the disease. It is probable, too, that the average serum cholesterol (283 mg./100 ml.) of the subjects with clinical disease was significantly higher than that (243 mg./100 ml.) of the healthy persons of both groups.

On the other hand, such factors as average

height, weight, the catamenia, the dietary intake of total calories and of total and animal fats, the ingestion of alcohol, the smoking of cigarettes, exercise, the presence or absence of parental history of coronary artery disease, and the time for blood coagulation appeared to be the same in both the total group of subjects with and those without clinical coronary heart disease. Certainly the finding of as much or higher incidence of ischemic heart disease in the respective groups of nuns, as compared to that found in the lay subjects, indicates clearly the failure of either cigarettes or alco-

hol to intensify the incidence of the disease under investigation in our subjects.

Many women with clinical disease were employed outside the home (83 per cent). The factor of working per se did not appear of etiologic significance, however. Thus, although clinical disease was observed mainly in working group A women, it was found only in one of 48 working women in group B and was absent in a total of 145 working women of both groups. The nature of the work appeared to have greater significance, however. Thus, although only 35 per cent of all subjects were in professional and executive occupations, 62 per cent of women with clinical disease were in these occupations. In contrast, although 65 per cent of the subjects were white collar workers or did not work outside the home, only 38 per cent of those with clinical disease were found among the latter subjects.

The high incidence of clinical disease in women in the executive occupations in this study of course is influenced by the choice of subjects by the lay selectors and a similar high incidence might not be found in a survey of a much larger random female population. It is certainly a simplification to state that, as found by us earlier in males exhibiting behavior pattern A,¹ the key area of harassment of all group A female subjects and particularly in those in the executive occupations was their great sense of time urgency and chronic lack of time for their usually multiple occupational duties, and many avocational involvements in clubs, societies, charitable organizations, civic and community activities, etc., types of involvements and recurrent deadlines almost entirely absent in the group B women. The latter housewives, of course, were often faced with different types of time pressures and emotional harassment as in usual household activities, "carpools" for children, etc. However, the same pressures also were present in many of the 60 per cent of the executive women that also were married and the latter women were readily able to differentiate the nature of these deadlines and time pressures consequent to their occupational and avocational obligations outside the

house compared to the emotional and other stresses found in the home.

Discussion

The preceding observations obtained from a study of 257 women (including 39 nuns) selected solely by lay selectors who also assessed their behavior pattern suggest certain conclusions that appear to us to be valid.

First, that when the criteria characterizing what we have termed behavior patterns A and B were employed carefully to distinguish and separate premenopausal and postmenopausal female subjects, such separation resulted in two groups of subjects who did not show any significant differences in their average age, height, weight, incidence of parental ischemic heart disease, dietary consumption of total calories or of total or animal fat, involvement in physical activity, or in their catamenia.

However, both premenopausal and postmenopausal women exhibiting behavior pattern A also exhibited certain differences from their counterparts exhibiting pattern B. Thus, the pattern A women smoked more cigarettes, drank more alcohol, had a far higher incidence of arcus senilis, much higher serum cholesterol levels, and, among the premenopausal subjects, a significantly faster clotting time. These differences were similar to those previously found in men exhibiting behavior patterns A and B.¹ The difference in serum cholesterol levels in the female subjects is even more striking if one considers that the serum cholesterol exceeded 275 mg./100 ml. in 77 per cent of group A compared to 19 per cent of group B women, and exceeded 300 mg./100 ml. in 29 per cent of group A, but in less than 2 per cent of group B subjects. Conversely, serum cholesterols less than 225 mg./100 ml. were found in 59 per cent of group B, but only in 8 per cent of group A women.

The detection of four times as much clinical coronary heart disease in both the premenopausal and postmenopausal females exhibiting behavior pattern A as compared to the analogous females with pattern B, was similar to our earlier findings¹ in two similarly chosen groups of men who, although ingesting ap-

proximately isocaloric and "isolipid" diets, and indulging in approximately the same amount of exercise, nevertheless exhibited a similar marked discrepancy in their proclivity to clinical coronary disease.

The group of men with pattern A that exhibited this marked increase in coronary morbidity also smoked more and drank more alcohol, but after analysis of the internal data available¹ we did not find that either of these habits could be held responsible for their increased incidence of heart disease. The present study and comparison of a group of women (nuns) indulging in neither habit confirmed our earlier conclusion that the increased smoking and drinking indulged in by individuals with pattern A were associative rather than causative factors in the increased coronary disease morbidity of this particular group.

The increased incidence of coronary heart disease in the postmenopausal women with either pattern A or B is, of course, a finding to be expected. We are not prepared at this time to conclude whether this increased incidence is due to altered thrombogenic propensity or other metabolic change consequent to diminished hormone secretion or the relatively increased age per se. Certainly the equal or almost equal sex incidence of coronary heart disease of many non-Caucasian groups³ argues strongly against any specific female sex hormone protection against this disease and rather suggests that the higher incidence of coronary morbidity in males in this and other Western societies is due to factors enhancing the disease in this sex. Our earlier study in men¹ indicated that the group of subjects found to have clinical coronary disease was of the same average age (48 years) as that of the present group of female subjects having clinical disease. If such men had an associated drastic sex phenomenon, it escaped both their and our attention.

A finding of great interest to us was the three- to seven-fold higher incidence of diastolic hypertension found in both premenopausal and postmenopausal women exhibiting pattern A as compared to their counterparts

with pattern B. The mechanism responsible for this striking difference in subjects chosen solely because of their psychologic traits by lay selectors is not known by us. The association of diastolic hypertension with coronary heart disease in 34 per cent of our subjects was not a surprising phenomenon, however, in view of their already well-known relationship. The unexpected finding, however, of far more hypertension in all subjects with pattern A, whether or not clinical coronary disease was present, makes it difficult to determine whether this particular disorder played a major causal role in the coronary heart disease when coexisting in our subjects or whether both are only associative consequents of the behavior pattern itself.

It is questionable whether the greater incidence of obesity found in the cardiac subjects is significant. Certainly in our earlier study with males¹ no such increased incidence was found. Clinical disease was detected in four (22 per cent) of 18 obese women (weight exceeding 10 per cent greater than the ideal weight in the Metropolitan Life Insurance Company Standard Table) compared to 25 (10.5 per cent) of the nonobese females. On the other hand, the association of obesity and clinical disease was found only in group A, since clinical disease was not found in any of the obese subjects of group B.

Again as in this earlier study,¹ the markedly greater incidence of arcus senilis both in the group A women and in subjects with clinical disease was impressive. Its possible relationship, however, to the also present coronary heart disease or to some mechanism common to both remains unknown to us.

The mechanism whereby behavior pattern A increases the proclivity to clinical coronary heart disease remains to be fully clarified.⁷ We have not previously¹ or in the present studies found it ascribable to differences in diet, cigarette smoking, alcohol consumption, physical activity, or hereditary incidence of clinical coronary disease. The finding of a hastened blood coagulation time both in our earlier studies^{1, 2} and in the present study in premenopausal subjects with pattern A, of

course suggests that this particular factor may serve as a causal mechanism. We realize the insecurity of any conclusion based upon single determinations taken upon the small number of cardiac subjects, using a relatively crude external measure of thrombogenic proclivity. It is one reason that we ourselves continue to harbor only the suspicion rather than the conviction that it may well be that the subject with behavior pattern A consistently indulges in precisely those aggressive, competitive, and accelerated activities that, if indulged in by animals, do hasten the clotting time quite markedly.⁸ Other known attributes of subjects possessing behavior pattern A that may be of possible causal importance in their increased incidence of clinical coronary disease are their higher blood pressures, higher serum cholesterol levels,¹ and augmented daytime secretion of norepinephrine.⁹

Throughout this study, we have emphasized a behavior pattern and its association with increased incidence of clinical coronary disease. Such emphasis, however, should not be misconstrued as evidence that the relatively high dietary ingestion of cholesterol and fat by Western man plays a minor role in the pathogenesis of coronary artery disease. It is our present belief that this Western dietary with its propensity to elevate the serum cholesterol of man from his natal level of approximately 100 mg./100 ml. furnishes the basic area in which the entrance of this particular behavior pattern wreaks its additional damage. On the other hand, the present and our previous^{1, 2} observations again emphasize the hazard of ascribing to diet alone the mechanism responsible for serum cholesterol levels exceeding 225 mg./100 ml. in either sex, as well as indicating that, in a population where an overabundance of calories and fats in the diet is ubiquitous and probably so for many decades,¹⁰ diet alone cannot account for either the selective advent of clinical disease in certain subjects nor for the latter's considerable increase in recent decades. It would be of extraordinary interest to us to learn what effect, if any, this behavior pattern might have upon subjects whose ingestion of cholesterol

and fat is almost nil. Such a study seems never to be accomplished, since unfortunately, whether one follows the Negro, the Oriental, or the Yemenite as he enters Western society, concomitant with his exposure to and increasing assumption of facets of this particular behavior pattern, his intake of cholesterol and fat inexorably proceeds to increase. Conversely, these same groups in their native habitat, not only ingest low-fat diets but differ in innumerable variables, not to mention the absence of most facets of pattern A.

We would like to emphasize once more that behavior pattern A is neither a flagrant neurosis nor characterized by anxiety or other simple emotional stresses; it is a seemingly almost normal mode of living variously indulged in by perhaps millions of Americans. Unlike a neurosis, it has received more admiration than condemnation by most citizens. Its very ubiquitousness, its frequent capture even of the physician and researcher himself, its ability at times to afford both economic and social rewards are all characteristics that have acted to obscure its apparent adverse association with clinical coronary heart disease. Then too, its inability to be measured in classical quantitative terms and its lack of an epidemiologic base have favored its neglect—a neglect that we believe has become increasingly perilous in most current clinical and epidemiologic studies.

Summary

The possible effect of a specific overt behavior pattern upon serum cholesterol levels, blood coagulation, and incidence of arcus senilis and clinical coronary heart disease was studied in two groups of women randomly chosen for study by lay selectors after careful orientation. Women of group A were selected on the sole basis of their habitual exhibition of a behavior pattern (type A) characterized by excessive competitive "drive," ambitiousness, and immersion in "deadlines." Women of group B were selected by lay selectors on the sole basis of their exhibition of entirely opposite behavioral traits (type B). Each group of subjects included a series of nuns respectively exhibiting the type A and B be-

havior patterns. The women exhibiting pattern A also exhibited markedly higher serum cholesterol levels, often more rapid blood coagulation, three to five times as much arcus senilis, three to seven times more diastolic hypertension, and a four-fold higher incidence of clinical coronary disease. A history of myocardial infarction or angina pectoris only was found in group A. These striking differences were independent of differences in parental incidence of coronary disease, caloric or fat intake, obesity, physical activity, smoking, or "femininity." The strikingly higher incidence of clinical disease in pattern A women also was not found ascribable per se to differences in heredity, obesity, hypertension, caloric or fat intake, smoking, physical activity, blood coagulation, or serum cholesterol levels.

The results closely resemble those previously found in men with similar behavior patterns, and strongly suggest that the type A behavior pattern is itself in some way largely responsible for the observed findings.

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