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INTRINSIC JOB STRESS AS A PSYCHOSOCIAL CORRELATE OF DIASTOLIC BLOOD PRESSURE IN A SAMPLE OF FEMALE HOSPITAL WORKERS

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A B S T R A C T

Intrinsic job stress is a composite index made up of the linear addition of seven different dimensions of perceived role stressors that share the common attribute of being related to job content. This is quite different from extrinsic job stress which is more related to the job context. In a larger study involving 1 000 hospital workers, intrinsic stress has been demonstrated to be significantly correlated with a decrease in absenteeism *(Arsenault and Dolan, 1983)*. This study reports on the correlations between intrinsic job stress, with diastolic blood pressure, while obesity and age are held as covariates in a subgroup of 365 female workers who had no personal history of hypertension. The results indicate that, after adjustments for obesity and age, intrinsic stress is significantly correlated with an increase in diastolic blood pressure ($p < 0.05$). Furthermore, this relationship is significant only for the younger female population. We believe this to be the first demonstration that perceived dimensions of intrinsic role stressors can be significant psychosocial correlates of an objective biological response.

RÉSUMÉ

« *Le stress intrinseque et la pression artérielle diastolique chez un groupe de travailleuses du milieu hospitalier.* »

L'indice de stress intrinsèque est un indice construit par l'addition linéaire de sept dimensions qui représentent les perceptions du travailleur quant aux caractéristiques inhérentes au contenu de la tâche. Par opposition, les sources de stress extrinsèques désignent plutôt les caractéristiques qui font partie du contexte de la tâche. Lors d'une étude de plus grande envergure chez 1 000 travailleurs hospitaliers, une corrélation significative a été démontrée entre le stress intrinsèque et une diminution de l'absentéisme *(Arsenault et Dolan, 1983)*. Cette étude en est une de corrélations multidimensionnelles entre le stress intrinsèque avec la pression artérielle diastolique chez un groupe de 365 femmes sans histoire connue d'hypertension. Les résultats indiquent qu'il existe une corrélation significative entre le stress intrinsèque et la pression artérielle diastolique, une fois l'obésité et l'âge pris en compte ($p < 0.05$). De plus, il est à noter que cette relation significative s'applique uniquement aux jeunes femmes de notre cohorte. Nous croyons ceci être une première démonstration d'une relation psychosociale entre une dimension perceptuelle de stresseurs intrinsèques et une réponse biologique objective.

INTRODUCTION

During the last few decades research has shown growing interest in the impact of stress at work on personal and organizational outcomes *(Beehr and Newman, 1978; Cooper and Marshall, 1976)*. While it has been known for some time that stressful events may yield changes in various cardiovascular parameters *(Brod, 1970)*, in the field of organizational stress, few studies have reported relationships between chronic occupational stress and changes in an objective biological response such as blood pressure.

Considering that there has been abundant argumentation on the interpretation of results when both independant and dependant variables are obtained from the same subjective self-report instrument *(Fried et al, 1984; Payne et al, 1982)*, we consider it of interest to regard the relationships between a subjective appraisal of job demands and an objectively measured consequence such as blood pressure.

Some impressive studies of occupational demands and worker's health have been carried out but no significant associations have been reported between stress scores and recorded arterial pressure *(Aro, 1982; Caplan et al., 1975)*.

Systolic blood pressure is known to vary quickly and react to acute changes and events through sympathetic stimulation. On the other hand, diastolic blood pressure changes may be a more appropriate criteria for identifying chronic work stressors. Reports where correlations have been found between stress and increases of blood pressure particularly diastolic blood pressure, have been concerned with acute psychological and/or mental stresses (mental arithmetic and difficult frustating cognitive tasks) *(Bonelli, 1982; Manuck, 1981; Sedgwick, 1981)*. Other authors have studied relationships between changes in blood pressure under acute stress in relation with type A coronary prone behavior *(Glass, 1977; Light, 1981; MacDougall, 1981; Manuck, 1978; Newlin, 1982)*.

In order to study the effects of stress on arterial pressure it is important to take into consideration three variables with which it is strongly correlated : sex, age and obesity. Increases of blood pressure occur particularly in middle age; moreover previous reports have shown that this relationship is not strictly linear: diastolic blood pressure has a tendency to increase more rapidly in women between 40 and 55 years of age *(Kannel et al, 1967)*. In our sample population we have observed similar results with an accelarated tendency towards increased blood pressure starting approximately at 35 years of age. Moreover the relationship between age and obesity appears to show the same type of non-linear tendency *(Kannel et al, 1967; Reisin et al, 1978)*, with an accelarated trend starting around 40 years of age. By contrast these two relationships appear to be linear for males. Consequently, in order to study diastolic blood pressure in a group of women, adjusted for the concomitant effect of age and obesity, one has to take into account the non-linearity of those phenomena.

METHODS

This study is an analysis of the relationships between age, obesity, diastolic arterial pressure and intrinsic job stress.

An original sample of about 1 000 hospital workers volonteered to participate in a broader cross-sectional survey on occupational stress. Admission criteria included minimal seniority on the present job (6 months) and a minimum of 25 hours of work per week. These were considered critical control measures for a study of chronic and recurring occupational stress.

The effect of sex was controlled by process of elimination. Our original sample included only 19% males, which is characteristic to hospital milieu, so for this analysis we considered only the female population. Moreover only women with no known personal history of hypertension were retained in order to eliminate the possible effects of medication and/or medical control. Data was collected by self-report questionnaire and a physical examination.

Age was obtained from the questionnaire using 9 pre-defined categories. Because of the phenomenon of non-linearity between age and arterial pressure as discussed earlier, three sub-groups were defined: younger less than 35 (N = 226), middle-aged, between 35 and 49 (N = 110), and older, above 50 (N = 39).

Obesity Index: Weight was measured without shoes and in working uniform. Height was measured by a metal height scale attached to the weight scale. The obesity index was obtained from the formula recommended by *Florey (1970) and Goldbourt and Medalie (1974)* and used by *Caplan et al. (1975)*.

$$\text{Obesity Index} = \frac{\text{Weight (in pounds)}}{\text{Height}^2 \text{ (in inches)}} \times 100$$

The distribution of the index is slightly skewed to the right, our population having a tendency to be overweight.

Diastolic blood pressure was measured in a standing position using a standard sphygmomanometer by a trained registered nurse. The measure was repeated in the supine position after two minutes of stabilization. All measurements were made on both arms and subjects with a difference equal to or greater than 10 mmHg were excluded. The values represented in this analysis are those of the mean diastolic blood pressure obtained in the standing position. The results for arterial pressure recorded in the supine position are similar.

Fifteen different sources of stress were measured using **Likert**-type scales. Based primarily on conceptualization derived from previous research *(House, 1974; Caplan et al, 1975)* and adapted in content and wording to the present study population, these were classified into two major categories: job context and job content sources of stress. Then it was decided to combine the various scales into two summary indices. The reasons for this were twofold: Most of the

research in this field tends to treat the various role-stressors on a single basis and despite the many attempts to identify a universal stressor, it seems that results are often confounded with populations, jobs and special circumstances, preventing one from drawing general conclusions *(Cooper and Marshall, 1976; Van Sell et al, 1981)*. Even though it is acknowledged that much information on particular stressors is lost when a combined approach is used, it seems to provide one direction towards new theories in the domain of occupational stress. The **Intrinsic stress index** was derived by linear addition of the Z scores (scale score - mean of the scale, divided by the standard deviation)$\left(\frac{X - \bar{X}}{(S.D.)} = Z\right)$of the 7 job content stressors (See Figure 1.) The **Extrinsic stress index** was derived by linear addition of the Z scores for the 8 job context stressors (See Figure 1). The zero-order correlation between these two indices is 0.28 *(Arsenault and Dolan, 1983a; 1983b; Dolan and Arsenault, 1984)*. A detailed discussion of the psychometric properties of this procedure is given elsewhere *(Arsenault and Dolan, 1983a, 1983b)*. In this particular analysis, no significant relationships were recorded for the Extrinsic stress index and the diastolic arterial blood pressure, thus the emphasis in this paper is on the relationship between the Intrinsic job stress index and the diastolic blood pressure.

RESULTS

Figure 11 is a schematic diagram of the correlation matrix between all concerned variables for this particular sample population, that is women with no known personal history of hypertension. Diastolic blood pressure is significantly correlated with age, obesity and intrinsic job stress. Extrinsic stress is not related to any parameter and intrinsic stress is independent from either age or obesity.

INSERT FIGURE 2 HERE

Because of the non-linearity phenomenon already suggested for age and arterial pressure, linear regression in groups was used to examine the different relationships between age, obesity, stress and diastolic blood pressure, as a function of three separate age groups: from 20 to 34; 35 to 49 and over 50.

The next three tables (Tables I, II and III) represent the standardized regression coefficients (or beta weights) establishing the relationships between the different variables, for each age groups. Table I represents the younger group with women aged less than 35. In this group both obesity and intrinsic stress are significant predictors of diastolic blood pressure while the relationship with age is no longer significant.

Table II shows that in the middle-aged group, age and obesity are significantly correlated, yet only obesity remains as a significant predictor of blood pressure. The values we obtained for age and blood pressure were borderline with a $p = 0.06$.

In the older aged group, (Table III), only age remains a significant predictor for diastolic blood pressure.

This varied evidence supports our assertion that when we study the phenomenon of work stress in regard to blood pressure, the model may definitely not be the same for all age groups.

Effectively, if we look at the dynamic of the relationship between Job demands and diastolic blood pressure, the later seems to have predictive value based on reported intrinsic stress only for the younger population. Because of the significant effect of age and obesity on diastolic blood pressure, we undertook a stepwise regression in order to look at the predictive value of the residual diastolic blood pressure on intrinsic stress, once age and obesity had been accounted for.

Table IV represents the F-to-enter values of each variable when we enter all of them, one after the other into the equation. When we look at the equation of the entire population (i.e.: all groups confounded), obesity enters first in the equation with a very high

significant value, followed by age. Yet, when the effect of both of these variables is being accounted for intrinsic stress still remains a significant predictor contributing to the explained variance of diastolic pressure. In the younger group, age does not enter the equation and obesity and intrinsic stress are both significant predictors of diastolic blood pressure.

CONCLUSION

We would then be able to postulate three different models, one for each age group. If we look at a resuming schematic diagram (Figure III), we would then remember that in the younger population both obesity and intrinsic stress are significant predictors of diastolic blood pressure. We must however formulate our conclusions in perspective, realising that our study has some constraints. Thus in this differential model, the younger population may be more prone to intrinsic stress perhaps because of insufficient experience or lower level of adaptation or coping in their particular work setting. As coping abilities increase with experience, the effect of intrinsic stress seems to disappear. Effectively in the middle-aged group only obesity is correlated with diastolic blood pressure. However this conclusion about coping may be mitigated by the fact that inabililty to cope with job pressures might have led to an opting out of some of our subjects (excluded from the study). This, of course we could not verify. Finally in the older population, age remains the main predictor for changes in arterial blood pressure. Obesity no longer appears to have a role. Here again, we cannot be sure as the population ages if the variable obesity has been eliminated because disease or increasing bad health had a morbidity effect. This age group represented very few nurses or executive but mainly blue collar workers for whom intrinsic stress may not be a problem.

We believe this to be a first demonstration that perceived dimensions of intrinsic role stressors can be a significant psychosocial correlate of an objective biological response. Implicated as well, that we should differentiate between different age groups when studying occupational stress and arterial blood pressure.

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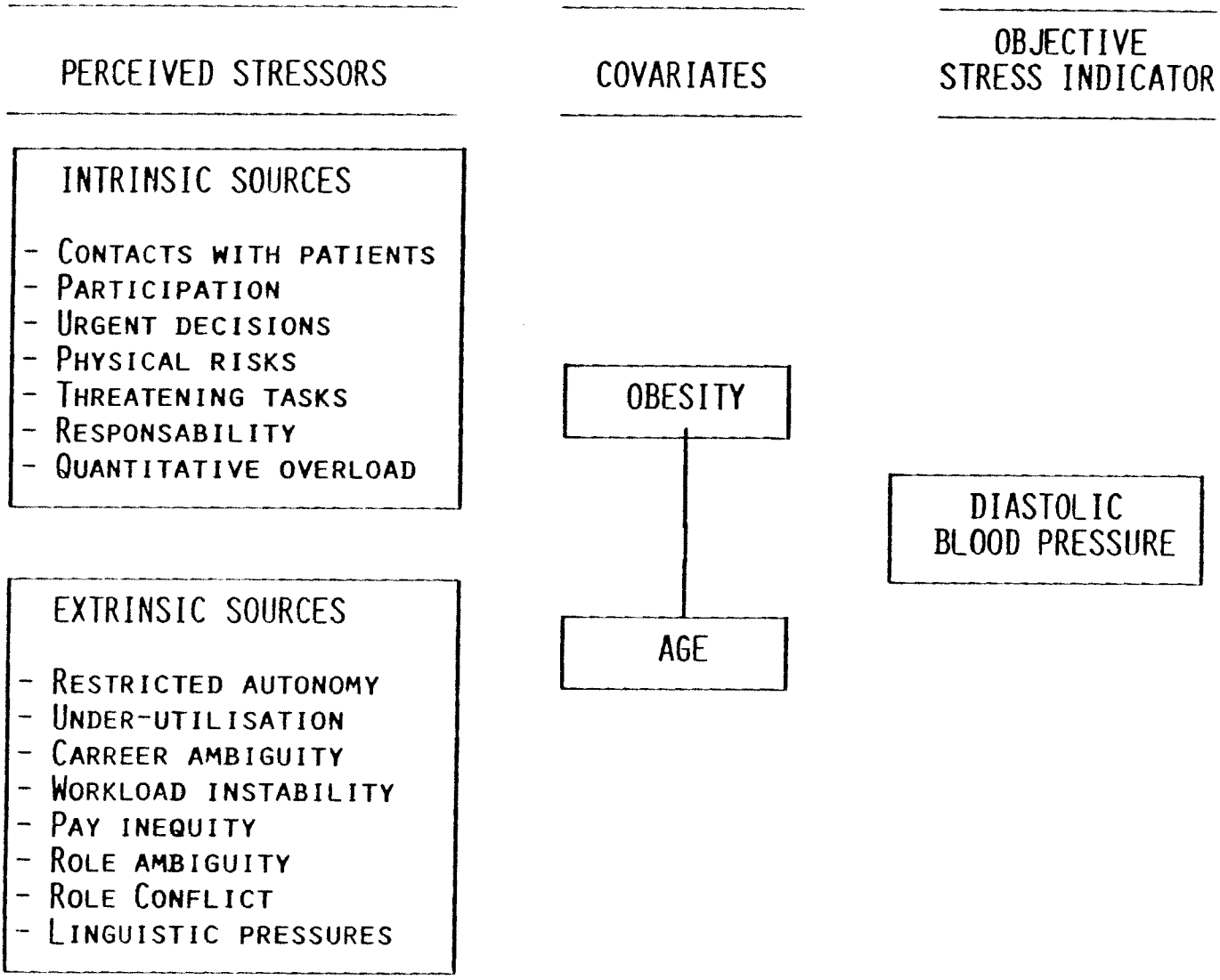
FIGURE I

SCHEMATIC FRAMEWORK FOR OCCUPATIONAL STRESS AMONGST FEMALE HOSPITAL WORKERS *



* FOR FURTHER DETAILS ON THE CONCEPTUAL MODEL WHICH GUIDED THIS STUDY, SEE: DOLAN and ARSENAULT 1980; ARSENAULT and DOLAN 1983a, 1983b, and DOLAN and ARSENAULT 1984.

FIGURE II

CORRELATION MATRIX

ALL AGE GROUPS

VENN DIAGRAM OF THE CORRELATION MATRIX FOR ALL AGE GROUPS CONFOUNDED. THE VALUES REPRESENT THE CORRELATION COEFFICIENTS. (MDBP = MEAN DIASTOLIC BLOOD PRESSURE.)

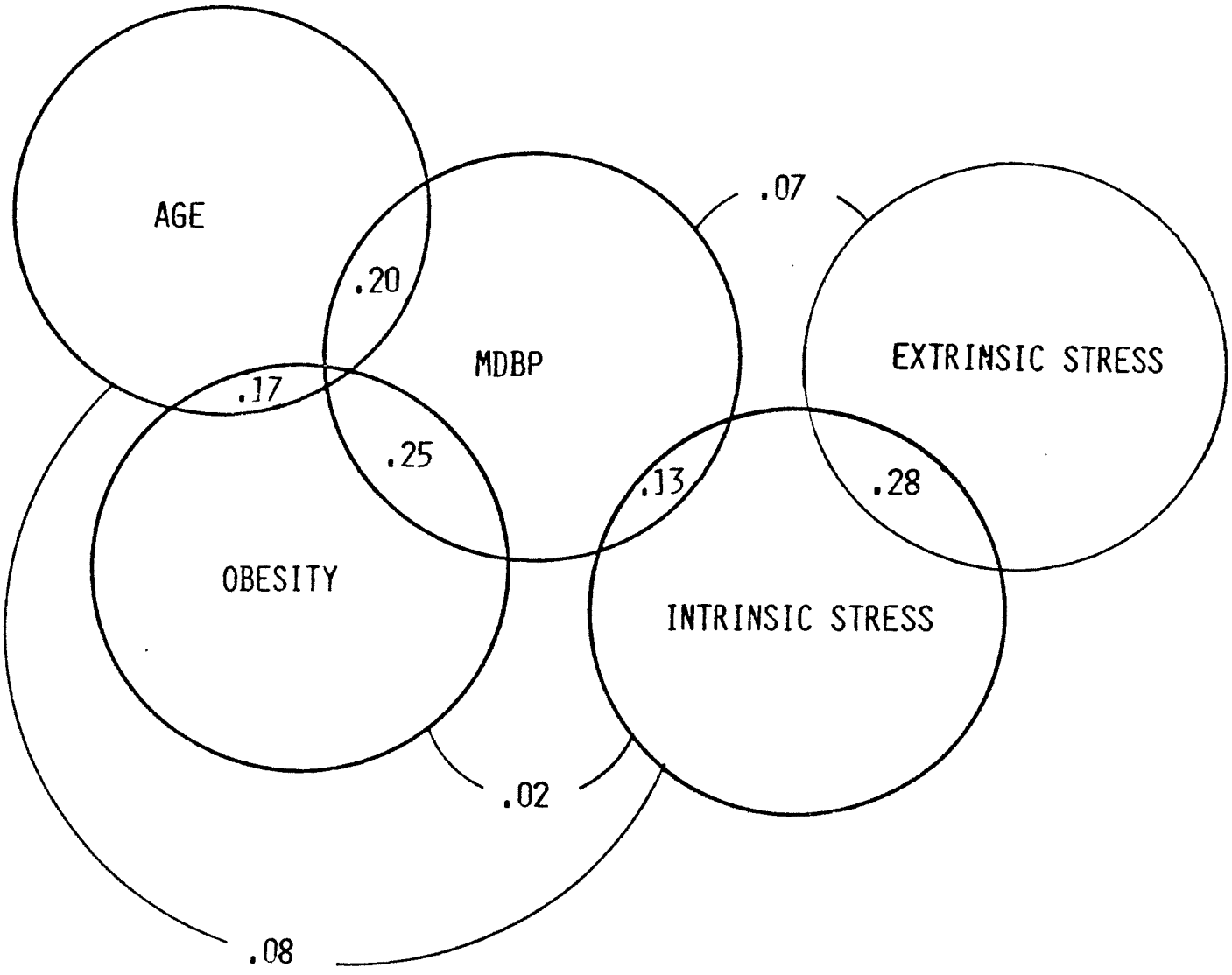
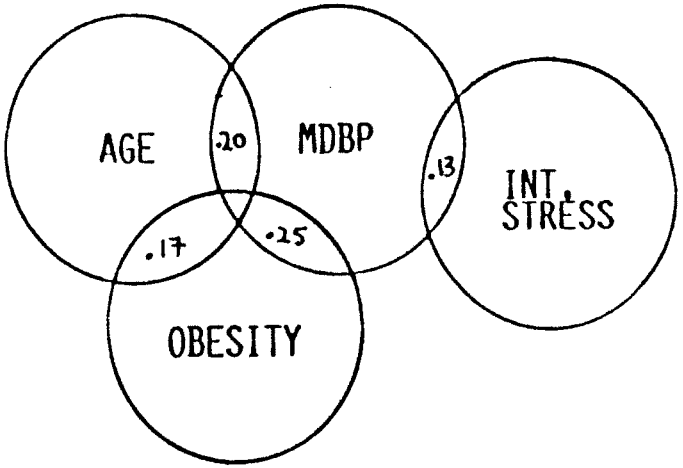


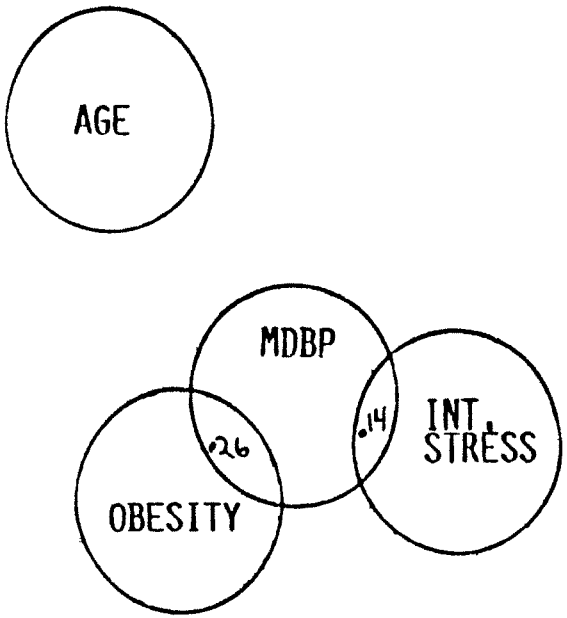
FIGURE III

ALL AGE GROUPS

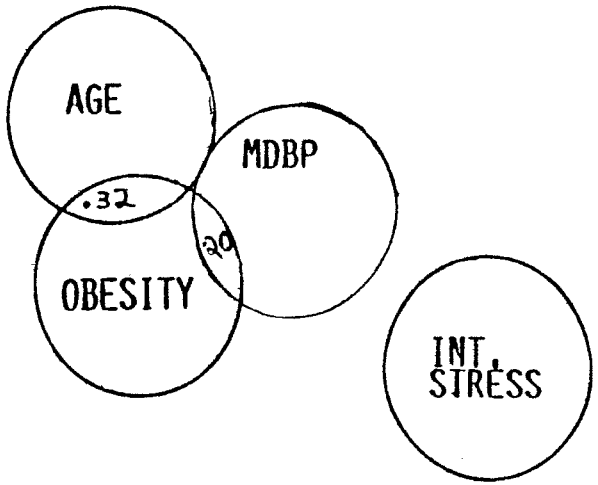


SUMMARY DIAGRAM OF THE ZERO ORDER CORRELATION FOR ALL GROUPS CONFOUNDED AND FOR ALL THREE AGE GROUPS. *

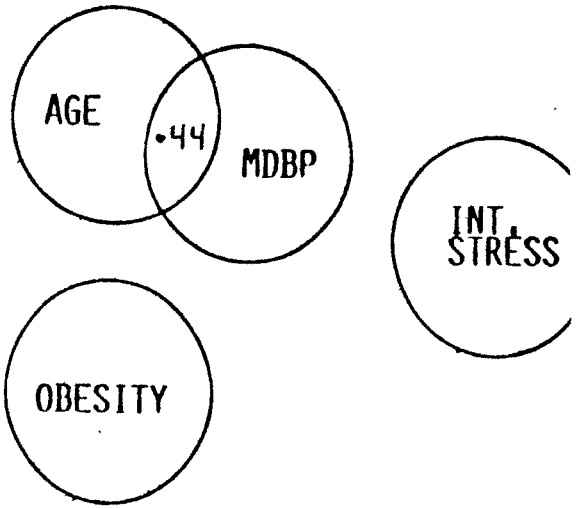
YOUNGER



MIDDLE AGED



OLDER



* $P < .05$ for all values reported

TABLE I

RELATIONSHIP BETWEEN DIASTOLIC ARTERIAL PRESSURE, AGE, OBESITY AND INTRINSIC WORK STRESS

YOUNGER (LESS THAN 35)
N=226

	DIASTOLIC BLOOD PRESSURE	INTRINSIC STRESS	AGE
OBESITY	.26***	N.S.	N.S.
AGE	N.S.	N.S.	
INTRINSIC STRESS	.15*		

THE VALUES REPRESENT THE STANDARDIZED REGRESSION COEFFICIENTS

* $P < 0.05$ *** $P < 10^{-3}$ N.S. NON SIGNIFICANT
** $P < 0.01$ **** $P < 10^{-4}$

TABLE II

RELATIONSHIP BETWEEN DIASTOLIC ARTERIAL PRESSURE, AGE, OBESITY AND INTRINSIC WORK STRESS

MIDDLE AGED (35 TO 49)
N=110

	DIASTOLIC BLOOD PRESSURE	INTRINSIC STRESS	AGE
OBESITY	.20*	N.S.	.32***
AGE	.18+	N.S.	
INTRINSIC STRESS	N.S.		

THE VALUES REPRESENT THE STANDARDIZED REGRESSION COEFFICIENTS

* $P < 0.05$
** $P < 0.01$
*** $P < 10^{-3}$
**** $P < 10^{-4}$
N.S. NON SIGNIFICANT

TABLE III

RELATIONSHIP BETWEEN DIASTOLIC ARTERIAL PRESSURE, AGE, OBESITY AND INTRINSIC WORK STRESS

OLDER (OVER 50)
N=39

	DIASTOLIC BLOOD PRESSURE	INTRINSIC STRESS	AGE
OBESITY	N.S.	N.S.	N.S.
AGE	.44**	N.S.	
INTRINSIC STRESS	N.S.		

THE VALUES REPRESENT THE STANDARDIZED REGRESSION COEFFICIENTS

* $P < 0.05$
** $P < 0.01$
*** $P < 10^{-3}$
**** $P < 10^{-4}$

N.S. NON SIGNIFICANT

TABLE IV

STRUCTURE BETWEEN INTRINSIC WORK STRESS AND DIASTOLIC BLOOD PRESSURE CORRECTED FOR AGE AND OBESITY

	STEPWISE REGRESSION (F-TO-ENTER)			
	LEVEL 1		LEVEL 2	
	AGE	OBESITY	INTRINSIC STRESS	EXTRINSIC STRESS
ALL	10.5**	24.8***	5.1*	(0.9)
YOUNGER	(0.3)	17.0***	5.4*	(3.1)
MIDDLE AGED	(1.6)	4.7*	(1.3)	(0.1)
OLDER	9.0**	(0.7)	(0.4)	(0.5)

* $P < 0.05$
** $P < 0.1$
*** $P < 10^{-3}$