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Prediction of early retirement on the basis of a health examination

An 11-year follow-up of 264 male employees in a Swedish pulp and paper company

by Nils-Erik Åstrand, MD,¹ Sven-Olof Isacsson, MD,¹ Göran O Olhagen PhD²

ÅSTRAND N-E, ISACSSON S-O, OLHAGEN GO. Prediction of early retirement on the basis of a health examination: An 11-year follow-up of 264 male employees in a Swedish pulp and paper company. *Scand J Work Environ Health* 14 (1988) 110–117. In a Swedish pulp and paper company 264 men in the age groups 36, 46, and 56 years underwent a health examination in 1972. An 11-year follow-up in respect of early retirement was performed. On the basis of collected data, five scales to assess work ability were established. The scales were (i) self-assessment of health and work capacity, (ii) the doctor's evaluation of general medical work capacity, (iii) the doctor's assessment of medical adaptation to work, (iv) aerobic work capacity, predicted from a submaximal bicycle test, and (v) work performance, determined from an interview with the subject's nearest superior. Multivariate analysis of the five scales and about 30 other variables showed that general medical work capacity was one of the strongest predictors of early retirement. It was also shown that the medical variables were better predictors of early retirement than the psychological and sociological ones. It was concluded that it is possible to predict early retirement on the basis of a health examination within an occupational health organization.

Key terms: employee performance appraisal, epidemiologic study, follow-up studies, health status index, health surveys, physical fitness, self-assessment, work capacity evaluation.

Preemployment and periodic health examinations performed by occupational health services usually aim at recognizing risk individuals, risk groups, and risk factors and not at detecting conditions responding to conventional medical treatment. Appropriate scales for the evaluation of an individual's general work capacity and ability to adapt to a specific type of work are a prerequisite for the systematic identification of those persons who are not suitable for a specific job or who require special precautions in order to do their job without risk to their health.

There are several reports regarding functional ability and disability scales, but they are more useful for rating disabilities to perform certain movements and muscular activities such as climbing stairs, carrying heavy loads, and other such activities. An overview of these scales has been written by Kaufert (20).

There are also scales to evaluate a number of defined work-related abilities and disabilities. Some of them are structured as work-capacity profiles with corresponding scales to evaluate physical demands at the work site (16, 18). Scales for evaluating general medical work capacity are used in some Swedish occupational health services, but no prospective evaluations can be found in published reports.

In an article from 1986 Charlson et al (10) stated that clinical judgment is widely used in medical practice

but that a systematic appraisal of such ratings has not yet been reported. They showed that physicians' severity ratings were a significant predictor of in-hospital mortality.

Prospective studies of self-rated health in genuine working populations have not been reported. Palmore showed that self-assessed health among 60- to 79-year-old men was the best predictor of longevity among several tested variables, better than the medical assessment of physical function, and the best predictor of early retirement (26, 27).

Aerobic work capacity, more often referred to as physical work capacity, was earlier characterized as an indicator of ability to produce, but the need for physical energy expenditure has diminished with the diminishing number of heavy occupations in industrial countries (21). Physical work capacity is today, therefore, investigated more as a health factor (5, 11, 17, 28, 29, 31).

Several studies report an association between physical work capacity and risk factors for coronary heart disease (8, 11, 28, 31). We found only one prospective study reporting physical work capacity as a predictor for a defined disease, myocardial infarction, in a homogeneous working population (29).

An assumed association of physical work capacity with sick leave and productivity measures has been investigated in several studies, but the results were contradictory (5, 6, 7, 12, 22).

The objective of the present study was to investigate (i) the cross-sectional relations of work performance with aerobic work capacity, self-ratings, and doctor's ratings of general work capacity and medical adaptation to work and (ii) the predictive power of the afore-

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mentioned factors and other risk indicators for early retirement.

Subjects

The subjects consisted of 264 men who were all working at the time of the base-line examination in 1972. They were split into three groups according to age (36-, 46-, and 56-year-olds). They were all employees of Svenska Cellulosaaktiebolaget (SCA), a pulp and paper company, and worked at one of four work sites situated in or close to Sundsvall, Sweden.

The selection procedure was designed to fit purposes other than those of the present study. The 36-year-olds were selected from the staff register as those 100 men who worked at any one of the four work sites and who were aged 36 years, or as close to that age as possible, at the time of the examination in 1972. The selection was performed in 1971. The 46- and 56-year-olds constituted the currently employed fraction of two groups of about 100 men who were selected in 1961 for an investigation into the relation between age and health among working men. The selection procedure was the same as described for the aforementioned 36-year-olds. Twenty-four percent of the 46- and 56-year-olds included in this study had left the company for other employment during the period 1961–1972.

The nonparticipation rate was 15 % for the 36-year-olds, 14 % for the 46-year-olds, and 5 % for the 56-year-olds.

The mortality rates for the participants and non-participants during the follow-up were 1 and 11 % for the 36-year-olds, 3 and 23 % for the 46-year-olds, and 13 and 20 % for the 56-year-olds, respectively. The corresponding early retirement rates were 2 % and unknown for the 36-year-olds, 10 and 33 % for the 46-year-olds, and 39 and 25 % for the 56-year-olds, respectively.

The total number of subjects in the age groups 36, 46, and 56 years who were examined in 1972 was 270. Five subjects were granted early retirement with a disability pension before 1972 and were excluded from this study. One subject was missing because of technical reasons.

About 25 % of the men worked as clerks and 75 % as manual laborers. The assessments were based on affiliation in trade unions. Supervisors, engineers, and managers were included in the group of clerks. The manual workers were occupied in barking, grinding, washing and straining, bleaching, operating paper and pulp machines, working in the soda boiler room, producing chlorine, packing, working in the steam power station, or repairing. The production units had the character of a process industry. Changing positions within the company was common. The repairers usually worked about half of the time in the production units and half of the time in the workshop. Exposure to heat, moisture, noise, and, at some places, cold and draft was common but mostly of limited dura-

tion. Physically stressful work loads occurred only to a limited extent and were usually not of a continuous character.

Methods

The medical examination was carried out during the spring of 1972 and was performed by one doctor and two experienced nurses. It started with urine and blood tests on samples taken from the subjects while they were in a fasting state. After the tests a light morning meal was served. The examination was continued with a questionnaire which was a Swedish modification of the Cornell Medical Index (CMI) (9, 14). A structured interview and a nonstructured interview complementing the questionnaire were included in the medical examination. The former comprised questions about angina pectoris, which was defined as chest pain on exertion, relieved within 10 min by the subject's resting (30). Questions on drugs prescribed for pain relief, sedation, and sleep and on smoking habits and alcohol consumption were included in the structured interview. Blood pressure was recorded indirectly by a mercury manometer from the right arm according to norms of the World Health Organization with the subject in the supine position (34). It was read at the nearest 5 mm Hg (0.67 kPa). Phase five of the diastolic pressure was recorded.

Aerobic work capacity was expressed as maximum oxygen uptake ($\dot{V}O_2$ max) levels and was based upon submaximal ergometric bicycle procedures described by Åstrand (1). The exclusion criteria were in accordance with a memorandum from the Medical Department of the National Board of Occupational Safety and Health in Stockholm (personal communication). A bicycle ergometer was used, and a trained nurse carried out the tests, which were performed with work loads of 50, 100, and 150 W, 6 min at each load. All the 46- and 56-year-olds had undergone a similar fitness test earlier. The test experience of the 36-year-olds was unknown.

Neuroticism was recorded on the basis of a scale of neuroticism constructed by Marke & Nyman (23) for 32 questions from the Swedish modification of the CMI (23). The reliability of this scale is reported to be 0.88 for men. The discriminating power was at least 0.60 for 27 of the 32 questions of the scale.

The psychological examination was performed by one psychologist. Three tests measuring mental abilities were performed. One of them, the most age-independent, was used in this study — "Synonyms," in Sweden called "SRB:1," a test measuring verbal ability with a reported reliability of 0.95 (13).

The sociological examination was carried out by two sociologists instructed by one coordinator. The sociological variables used in this study were education, recorded from a structured interview, and seven scales on self-perception of work and the work en-

vironment, recorded from an inquiry supervised by one of the sociologists.

The seven scales included ratings regarding general satisfaction with present work and employer, work involvement, job-related mental strain, influence on one's own work situation, feeling of affinity with co-workers, possibility of communication with co-workers, and perception of physical work environment factors as strenuous.

The scales used, subsequently referred to as Gardell's scales, were constructed on the basis of factor analysis. The first six scales have been described in a publication by Gardell (15) and the seventh in a personal communication from him in 1971. Determination of the reliability of the internal consistency by Cronbach's alpha showed the majority of the scores to be greater than 0.80, and the minimum score to be 0.75 (14, 15).

The follow-up was terminated on 31 December 1983.

The details of the early retirements with disability pensions granted in the period 1972–1983 were obtained from the Public Social Insurance Offices in 1984. The records included all diagnoses obtained from the medical certificates required for early retirement. Up to five diagnoses per case were reported. The principal diagnoses at early retirement were recorded from the National Social Insurance Board in 1986.

The outcome variable in this study was the first event of early retirement with a granted disability pension, partial or complete, temporary or permanent.

In spite of the differences in regard to the degree and permanency of work disability, there is a minimum requirement common to all forms of early retirement with disability pensions in Sweden, ie, a minimum of 50 % reduction in work capacity over a long period of time.

By Swedish law (since 1976), one can also be granted early retirement because of reasons referable to the labor-market situation. This type of retirement is restricted to persons aged 60 years or more. In this study no subject was granted a disability pension for labor-market reasons.

Based on the aforementioned examinations and interviews, the following five central variables were constructed:

1. *Self-assessed health and work capacity*: a trichotomic scale, in this study dichotomized into "good" and "reduced."
2. *General medical work capacity*: doctor's assessment, a quadrotomic scale, in this study trichotomized into "good," "fair," and "reduced."
3. *Medical adaptation to work*: doctor's assessment, a quadrotomic scale, in this study dichotomized into "good" and "reduced."
4. *Aerobic work capacity*: maximal oxygen uptake in liters per minute. The variable was normally distributed

and divided into quartiles before the analysis. For use in the life-table analysis, it was trichotomized into the low first quartile, a middle interval comprising the second and third quartiles, and the high fourth quartile.

5. *Work performance*: foreman's or the employee's superior's assessment, a scale of five categories, in this study trichotomized into "good," "fair," and "reduced."

A detailed description of the scales can be obtained upon request.

The interviews were performed in October and November 1972.

In the case of employees who left the company and went to other enterprises, the scale used, with explanations, was sent to the respective superior as a questionnaire.

The five central variables and an additional 33 other variables were used in the multivariate analysis. The variables were chosen on principle in accordance with Palmore's theoretical model for the prediction of early retirement (27), which includes demographic, socioeconomic, health, and job factors and attitudes towards retirement. Attitudes towards retirement were not recorded for the 36- and 46-year-olds and subsequently were excluded from this study. Variables known to contribute to the doctor's assessments were given priority. Anamnetic and physical examination data were used. These included blood pressure, evaluation of electrocardiograms, history of angina pectoris, and reported symptoms from the musculoskeletal system. Other variables included were serum cholesterol levels, use of tobacco, alcohol, and analgesics, tranquilizing or sedative drugs, self-reports of physical exertion during leisure time, results of the Markey-Nyman scale of neuroticism, results of the psychological verbal test, results of the seven Gardell scales, and variables applicable to education and occupational status.

Statistical methods

Fischer's exact test was used to calculate the significance of differences in mortality and early retirement between the participants and nonparticipants.

Yates' corrected chi-square was used for other classes with one degree of freedom, and Pearson's chi-square was used for classes with more than one degree of freedom.

An analysis of variance was used for the calculation of the statistical significance of the variation of aerobic work capacity with work performance.

The Kaplan-Meier method was used to analyze the predictive power of each of the five central variables with regard to early retirement.

The Cox regression was used for the multivariate analysis of early retirement.

Table 1. The five central variables distributed according to age group.

Age group	Self-assessed health and work capacity				General medical work capacity				Medical adaptation to work				Aerobic work capacity (l · min ⁻¹)		Work performance							
	Good		Reduced		Good		Fair		Reduced		Good		Reduced		Mean	SD	Good		Fair		Reduced	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%			N	%	N	%	N	%
36-year-olds	93	93	7	7	40	40	51	51	9	9	92	92	8	8	2.53	0.54	51	51	36	36	13	13
46-year-olds	71	92	6	8	16	21	48	62	13	17	66	87	10	13	2.27	0.46	45	63	19	27	7	10
56-year-olds	69	80	17	20	7	8	42	48	38	44	56	64	31	36	2.12	0.42	33	40	31	37	19	23

Table 2. Correlations of work performance with the other four central variables.

Work performance	Self-assessed health and work capacity				General medical work capacity						Medical adaptation to work				Aerobic work capacity (l · min ⁻¹)	
	Good		Reduced		Good		Fair		Reduced		Good		Reduced		Mean	SD
	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
Good	119	92	10	8	37	29	72	56	20	15	114	88	15	12	2.34	0.54
Fair	78	92	7	8	16	19	46	53	24	28	67	78	19	22	2.30	0.47
Reduced	28	72	11	28	8	21	18	46	13	33	25	64	14	36	2.38	0.49
	P = 0.001				P = 0.063						P = 0.002				P = 0.710	

The criterion of statistical significance was set at $P < 0.05$.

Results

The number of early retirements in the follow-up period was 44. The distribution was 34 early retirements among the 56-year-olds, eight among the 46-year-olds, and two among the 36-year-olds. Thirty-six percent of the principal diagnoses revealed by the early retirement certificates were categorized as musculoskeletal disorders, 34 % as circulatory disorders, and 9 % as mental disorders. The average yearly early retirement rate was 3.4, 0.9, and 0.2 for the respective 56-, 46-, and 36-year-olds.

Table 1 shows the five central measurements of work ability in relation to age. All showed an inverse relationship to age.

Table 2 shows the correlation between work performance and the four other central variables. Work performance was associated with self-assessed health and work capacity ($P = 0.001$), and with medical adaptation to work ($P = 0.002$). It was not significantly associated with general medical work capacity ($P = 0.063$) or aerobic work capacity ($P = 0.7$).

Figure 1 shows the life-table analysis of self-assessed health and work capacity as a predictor of early retirement during the 11-year follow-up. Subjects with a reduced self-assessed health status showed 52 % early retirement in comparison with 12.5 % for subjects with a good self-assessed health status. The difference was statistically significant ($P < 0.001$).

Figure 2 shows the life-table analysis of general medical work capacity as a predictor of early retirement. Subjects with a reduced general medical work capacity showed 50 % early retirement in comparison

Proportion

Figure 1. Cumulative proportion of early retirement in 1972–1983, as calculated in a life-table analysis, according to the subjects' self-assessed health and work capacity. [—] assessed as good (number of subjects at start 233), assessed as reduced (number of subjects at start 30)]

with 11 % for subjects with a fair rating, and 3 % for those with a good rating ($P < 0.001$).

Figure 3 shows the corresponding analysis of medical adaptation to work. Subjects with a reduced medical adaptation to work showed 50 % early retirement in comparison with 10 % for those with good adaptation ($P < 0.001$).

Figure 4 shows the life-table analysis of aerobic work capacity as a predictor of early retirement. There were

Figure 2. Cumulative proportion of early retirement in 1972–1983, as calculated in a life-table analysis, according to general medical work capacity. [— assessed as good (number of subjects at start 63), ---- assessed as fair (number of subjects at start 141), assessed as reduced (number of subjects at start 60)]

Figure 3. Cumulative proportion of early retirement in 1972–1983, as calculated in a life-table analysis, according to medical adaptation to work. [— assessed as good (number of subjects at start 214), ---- assessed as fair (number of subjects at start 49)]

Figure 4. Cumulative proportion of early retirement in 1972–1983, as calculated in a life-table analysis, according to aerobic work capacity. [— high quartile (number of subjects at start 68), ---- second and third quartiles (number of subjects at start 128), low quartile (number of subjects at start 51)]

Figure 5. Cumulative proportion of early retirement in 1972–1983, as calculated in a life-table analysis, according to work performance. [— assessed as good (number of subjects at start 129), ---- assessed as fair (number of subjects at start 86), assessed as reduced (number of subjects at start 39)]

no significant differences regarding the predictive power of the different VO_2 max levels ($P=0.168$). Seventeen subjects were not tested for their aerobic work capacity. Five of the missing subjects were excluded from the test because of blood pressure ($>250/$

120), three because of heart disease, and four because of disorders of the musculoskeletal system. The test was stopped in two cases due to a high heart rate and in one case each due to intermittent claudication, angina pectoris, and back pain.

Table 3. Predictors of early retirement (analysis with covariates — Cox models).

Variable	Relative risk	95 % confidence interval
Age	7.2 ^a	3.4—15.1
General medical work capacity	4.2	2.1—8.6
Use of analgesic drugs	3.9	1.8—8.5
Self-perception of physical work environment factors	2.0 ^b	1.4—3.0
Work performance (Wp var 1)	4.6	2.0—10.8
Systolic blood pressure	1.2 ^c	1.1—1.5
Use of sedatives or tranquilizers	3.3	1.4—7.7
Work performance (Wp var 2)	2.5	1.1—5.5

^a The relative risk represents the effect of a 10-year increase in age.

^b Self-perception of physical work environment factors as strenuous was associated with a risk of early retirement. The relative risk represents the effect of a one-degree increase on a five-degree scale.

^c The relative risk represents the effect of a 10-mm increase in systolic blood pressure.

Figure 5 shows the life-table analysis of work performance as a predictor of early retirement. Subjects with a reduced work performance showed 34 % early retirement, subjects with a fair work performance 20 %, and subjects with a good work performance 10 % ($P = 0.001$). Ten assessments regarding work performance were missing. Six of the subjects had left the company and started their own enterprises and had no superior. One person was undergoing rehabilitation and was not eligible for assessment. Three subjects were employed elsewhere, and answers were not obtainable.

Table 3 shows the results of the Cox regression analysis for the prediction of early retirement. Age was the strongest independent predictor, showing a relative risk of 7.2 for a 10-year increase in age. General medical work capacity was the second strongest independent predictor, showing a relative risk of 4.2 for reduced general medical work capacity. The consumption of prescribed analgesic drugs showed a relative risk of 3.9 for the consumption of analgesic drugs for more than 10 d every year. The self-perception of physical work environment factors as strenuous showed an association with early retirement, ie, an implication of a risk of 2.0 for an increase of one degree on the five-degree scale.

During the Cox regression analysis of the work performance variable two dichotomized variables were created. The first was the genuine variable dichotomized by the limit of fair to reduced, called Wp var 1. The second was created correspondingly by the limit of good to fair and was called Wp var 2. The first variable (Wp var 1) showed a relative risk of 4.6 for reduced work performance when compared with good

and fair performance. The second (Wp var 2) showed a relative risk of 2.5 for reduced and fair work performance in comparison with good performance.

Systolic blood pressure showed a relative risk of 1.2 for the effect of a 10 Hg mm (1.33 kPa) increase in systolic blood pressure.

The consumption of sedative or tranquilizing drugs for more than 10 d a year showed a relative risk of 3.3.

Discussion

The nonparticipants were shown to have somewhat worse health than the participants in the analysis of mortality. Since the nonparticipant rate was low and the strengths and significances in this study were high, the nonparticipants' rate could not be supposed to bias the predictive results to any considerable degree.

The 36-year-olds were not experienced with the bicycle ergometer test. This inexperience could possibly have caused an underestimation of the $\dot{V}O_2$ max. However the relation between the $\dot{V}O_2$ max levels of the different age groups was similar to that of the Scandinavian standard (1).

Seventeen subjects who were supposed to have low $\dot{V}O_2$ max values were excluded from the $\dot{V}O_2$ max tests. Since similar exclusion criteria are widely used, similar subjects must be expected to be excluded in comparable populations. Therefore a discussion of their effect on $\dot{V}O_2$ max as a predictor for early retirement is meaningless from a clinical point of view. However we have given the 17 missing subjects artificial values low enough to give them positions within the low quartile of the $\dot{V}O_2$ max distribution. The life-table analysis then showed significant differences between the low, the two middle, and the high quartiles ($P = 0.001$).

The aerobic work capacity of all the subjects as a group was lower than the average in the Scandinavian standard, which reports values of 2.8—3.4 l · min⁻¹ as an average for men 30—39 years of age, 2.5—3.1 l · min⁻¹ for men 40—49 years of age, and 2.2—2.8 l · min⁻¹ for men 50—59 years of age. The comparatively low values should be considered in the light of the fact that the pulp and paper industry, previously known to be a comparatively heavy industry from a physiological standpoint, had become a processing industry with a reduction of physically heavy occupations as early as 1972. This evolution is illustrated by the fact that 66 % of the subjects reported a heavy physical work load in previous jobs and only 38 % of the subjects reported a heavy physical work load in their present jobs. The Scandinavian standard was established from results from selected populations in the late 1950s, and it is probably too high to represent the Scandinavian population of the early 1970s (1). The results in this study agree very well with the values reported for drivers, repairers, post office personnel, and commercial employees in the 1960s (2).

A rough comparison of the early retirement rate in this material with that of the whole of Sweden shows a somewhat lower rate for the former. This finding is an indication of the healthy worker effect (25). Information about nonparticipants, who showed a higher rate of early retirement only for the 46-year-olds, could aid in explaining the difference.

Of the three central medical assessment variables, general medical work capacity was the only one shown to be an independent predictor of early retirement by the Cox regression analysis. This observation is interesting since this variable can be considered to be the one of the three that contains the most purely medical health components. The variable medical adaptation to work includes work environment as a component by definition, and self-assessment of health is known to be influenced by different perceptions and aspiration levels (32, 33). Therefore poor medical health leads to early retirement in the long run, and this statement applies even to those subjects who showed good medical adaptation to work in the base-line examination.

Work performance was the second of the central variables shown to be an independent predictor of early retirement. No earlier report of work performance as a predictor of early retirement has been found by us. The predictive power of work performance could reflect occupations in which good work performance is possible in spite of considerable disabilities and/or some mental or other health defects not detected by the doctor.

The work-related aspects of early retirement were reflected by the Gardell indices. Only one of these indices, self-perception of the physical work environment factors, proved to be an independent predictor of early retirement. This variable is in fact composed of two components, the actual work environment and the attitudes towards it (15). The used variable does not allow for a separation of the two factors, but the appearance of this variable as an independent predictor must be interpreted as an influence of high job demands or the perception of high job demands on health. This result can be compared to Karasek's theory that a combination of high job demands and low decision latitude gives rise to mental strain and poor health (19). Despite our expectations, the influence on one's own work, as measured on one of Gardell's scales, was not an independent predictor of early retirement.

The use of analgesics, tranquilizers, and sedatives prescribed by a physician proved to be independent predictors of early retirement. Associations of the use of analgesic drugs with poor health have been reported earlier (24). The confinement to drugs prescribed by a doctor presumably increases the value of the use of analgesics as an indicator of poor health since it postulates repeated contacts with a physician and the physician's verification of a disorder that legitimates the use of drugs.

The psychological test regarding verbal ability was not an independent predictor of early retirement. This test has earlier been shown to be independently associated with back abnormalities but was not an independent predictor of early retirement (3, 4).

The appearance of the central variable general medical work capacity as a predictor of early retirement is interesting. The predictive power of this variable was, except for age, the most important of the independent predictors. If this variable were to be excluded from the equation, some of the relative risks provided by other medical independent predictors would possibly increase. However the doctor integrated many health indicators into his assessment. Some of these factors are comparatively rare, and therefore no independent power was shown in this study. Other factors gave small, separate contributions to the reductions of general medical work capacity but interacted with other factors that could not be supposed to show separate independent predictive powers in the computed analyses.

Moreover, our experience shows that complicated routines and analyses cannot be integrated into everyday occupational health services. This fact has also been pointed out by Greenwood (16). The use of a scale for the assessment of general medical work capacity founded on data from a health examination can therefore be recommended as central in the evaluation of the risk of individuals to be chosen for special observation or secondary preventive measures. This simple measure must be a cost-effective method. The addition of the other independent predictors reported in the present study increases the accuracy.

Of course the findings in this study cannot be applied to every working male population without objections. However, the present material was composed of subjects of different ages and with a variety of occupations and job demands. Therefore there is reason to believe that the method, as a whole, can be applicable to diverse working populations.

The medical, psychological, and sociological measurements were used in this study independently of each other. The medical measurements predominated the list of independent predictors. When the reasons for this outcome are evaluated, the selection of variables, the quality of the used variables, and their mechanisms of action on the end point have to be considered. The selection of variables was in accordance with Palmore's model for the prediction of early retirement except for attitudes towards retirement, which were lacking in this study (27). The quality of the psychological and sociological variables used was documented. The medical dominance among the independent predictors of early retirement can be explained by different positions in the chain of action. It is well known that psychosocial factors influence medical health. In the chain of causes medical health factors are situated closest to the end point, and there-

fore give the best independent prediction of early retirement.

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