

A new questionnaire and model for research into the impact of work and the work environment on employee health

by Gabriel Oxenstierna, PhD,¹ Maria Widmark, MPH,² Kristina Finnholm, MPH,¹ Stig Elofsson³

Oxenstierna G, Widmark M, Finnholm K, Elofsson S. A new questionnaire and model for research into the impact of work and the work environment on employee health. *SJWEH Suppl.* 2008;(6):150–162.

The research questions of this study were “Are there other organizational conditions or dimensions that generate ill health and that can complement the work-environment dimensions previously employed, and, if so, what are they, and how do they relate to earlier dimensions and employee health? A new survey questionnaire was built on a critical analysis of the demand–control–support model and the effort–reward imbalance model. Interviews carried out in eight strategically selected focus groups, along with one expert interview and one case study, made up the qualitative basis for the development of the new questions. The results from a pilot study involving a nationally representative sample provided the basis for the work and workplace dimensions studied and the construction of the hypothetical “causal” model. Factors of work and the workplace had an impact on employees’ stress symptoms and health. However, only “demands” and “humanity and social support” had a direct connection.

Key terms health, demand–control–support model, stress, workplace.

The currently predominant psychosocial work environment models and investigative questionnaires were developed almost 30 years ago. Since then, worklife has undergone radical changes. In Sweden, these changes happened late and with full force in the early 1990s. Industry experienced systematic, comprehensive rationalization of production processes, while the public sector saw sweeping cuts and reorganization. From 1990 to 1993 the labor force dropped by 732 000 persons, pushing unemployment up from 1.6% to 8.2% (1–4).

Shareholder interests and profitability have increasingly become dominant values. Lean production, spin-offs, mergers, and restructuring are now the guiding principles of corporate development—principles that have quickly spread to the public sector. The accelerated globalization of business, along with public-sector deregulation, privatization, and the adoption of purchaser–supplier models, has transformed the welfare state. Out of this transformation, new institutional forms have emerged, such as project, network, flat, and purchaser-supplier organizations. All of these changes suggest that extant psychosocial work-environment models may no longer be fully suited for modern worklife.

In their extensive review, Hurrell et al (5) went through nine questionnaires designed to measure stressors in worklife and their consequences in terms of self-rated stress and health. The authors argued that, because many of the questions in these surveys were formulated over 25 years ago, their relevance to a modern worklife no longer dominated by industrial production should be re-examined (5). The service sector has expanded, as have the health and caring, coaching, and administrative sectors. Given this development, can the existing measures of demands and the handful of dimensions studied really incorporate all the vital stress factors of modern worklife? Do existing surveys with their very limited number of parameters encompass the new conditions that these changes create? The problem extends to the output values of these surveys as well; how can stress and ill health actually be measured?

Hurrell et al (5) concluded that “job stress research over the past 35 years appears to have been dominated by investigations of a relatively few working conditions that use the same or similar measures . . . Existing job-stressor measures do not appear to adequately capture some of the important demands of work in these new

1 Stress Research Institute, University of Stockholm, Stockholm, Sweden.

2 Department of Nursing, University of Umeå, Umeå, Sweden.

3 Department of Social Work, University of Stockholm, Stockholm, Sweden.

Reprint requests to: Dr Gabriel Oxenstierna, IPM, Frescati Hagväg 16A, S-104 05, Stockholm, Sweden. [E-mail: gabriel.oxenstierna@stressforskning.su.se]

jobs and working environments [p 385]" (5). Ten years later, Härenstam & Wiklund came to the same conclusion (6, p 7).

The demand–control–support model was initially proposed by Karasek (7) and was further developed by him in collaboration with Theorell (8), as well as with Johnson and Hall (9, 10). In classic psychosocial work-environment research, the demand–control–support model occupies a dominant position, along with the effort–reward imbalance model developed by Siegrist (11, 12).

The creation of the demand–control–support model was based partly on the critical examination of two other work-environment models, namely, the job characteristics model and the Michigan organizational stress model. The job characteristics model relates work content to employee job motivation and satisfaction, while the Michigan organizational stress model treats stress very much as a subjective, personal phenomenon. Karasek & Theorell (8) argued, however, that far too little attention has been paid to the “objective” work environment. The models also differ in their view of individual personality in that, whereas the job characteristics model and the Michigan organizational stress model see it as an independent variable, the demand–control–support model considers it heavily influenced by work and the work environment.

Other influential work-environment models include the sociotechnical approach (Tavistock Institute), which focuses on the workgroup; the action–theoretical approach, which focuses on work duties; and the effort–reward imbalance model, which focuses on the balance between input and payoff. The effort–reward imbalance model is of particular interest to us, as there are similarities between the demand–control–support and effort–reward imbalance models as regards their concepts of demands–effort and social support–reward.

The most widely used questionnaire based on demand–control–support is called the job content questionnaire, which was developed in quality-of-employment surveys in the United States (US) in 1969, 1972, and 1977. The original core job content questionnaire contained 28 questions, the complete survey, from 1985, had 50. The Swedish demand–control questionnaire is a condensed and modified version of the job content questionnaire. Introduced in 1988, it contains 11 questions from the job content questionnaire along with six questions on social support that are directed at capturing workplace atmosphere. However, the “employment insecurity” and “physical demands” dimensions are absent from the demand–control questionnaire (13).

The demand–control–support model is a psychosocial work-environment model designed to give theoretical support to the investigation of which work factors actually cause problems (8, p 7). The model has proved

to be very successful in predicting ill health (particularly cardiovascular disease) and is also used nowadays for predicting other common stress-related problems, such as physical pain, fatigue, depression, and incapacity. Therefore, despite the fact that the demand–control–support model and the job content questionnaire and demand–control questionnaire were designed at a time and for a worklife different from today’s, the simplified questionnaires can still be used to predict a higher risk of long-term sick leave and cardiovascular disease (4, 14–16). This situation suggests that the overall concepts of demand and inadequate power of control are still relevant. However, the concepts are too general to be used for examining work-environment issues in current worklife, which has few similarities with that of 30 years ago, or for addressing current research concerns. The concepts must therefore be clarified and placed in a wider social and organizational context. Work-environment research requires that the operationalization of demands, control, and support truly measure what is intended. Work-environment research also requires the identification and operationalization of new dimensions in the work environment.

The effort–reward imbalance model, like the demand–control–support model, has often been used in studies of cardiovascular disease, in which it has demonstrated the ability to predict morbidity and mortality events. The model has also been used to study other types of workplace-related diseases and problems. However, there is reason to posit the presence of dimensions that the established models and their accompanying questionnaires fail to address. It might also be the case that certain dimensions remain “hidden” since definitions and their operationalization are often not sufficiently precise. We therefore aimed at examining which organizational conditions—directly or indirectly affected by social and structural changes—generate ill health at workplaces but are not covered by the predominant psychosocial (demand–control–support and effort–reward imbalance) work-environment models.

We decided to examine and develop the demand–control–support model, as it is currently the most influential stress model, and to try to merge it with the effort–reward imbalance model, since the two display considerable conceptual similarities. Since we intended to operationalize new dimensions and our wish was to avoid problems that could arise from the different cultural contexts, we chose to work with the short Swedish demand–control questionnaire as it was designed in Sweden and has been used in several epidemiologic studies. The chosen effort–reward imbalance questionnaire was the one condensed by Johannes Siegrist. Finally, we decided to create a completely new questionnaire and not to use existing ones developed in other contexts and build on other theoretical points of departure.

When our work began, the changes in worklife had not yet brought about new theories or more comprehensive questionnaires, even though certain aspects of new worklife could be detected in Swedish and international work-environment research. There is a relatively large volume of recent research into organizational conditions in relation to health outcomes (17–29). However, none of these studies aimed at developing theories or at creating a new questionnaire able to give a more complete picture of today’s work environment. Apart from the ongoing modernization of the job content questionnaire and its shorter Swedish version (the demand–control questionnaire), and the creation of the Copenhagen psychosocial questionnaire, we have not found any major development since Hurrell et al’s review paper (5).

Purpose and points of inquiry

The purpose of this explorative study was to pinpoint work-organizational conditions or dimensions that have a possible connection with social change and work-related health problems and that could conceivably lie close to or beyond the dimensions addressed by earlier psychosocial work models (demand–control–support and effort–reward imbalance). Our aim was to identify and describe these dimensions and to examine their possible relationships rather than to determine any causal links. The purpose was also to develop a new questionnaire for assessing and improving the psychosocial work environment. Furthermore, we hoped to develop questions about new worklife for the longitudinal, national database that the former Institute for Psychosocial Medicine intended to create.

The questions are as follows: (i) “Are there organizational conditions or dimensions that can generate ill health and that can supplement the dimensions of the classic work-environment models?”, (ii) “If so, what are they and how do they relate to the classic conditions or dimensions and to employee health?” The focus of the study was the organizational conditions that may be important for the psychosocial work environment and for health. The study did not consider the physical work environment, the employees’ personal responsibility for their health, or the extraneous factors that can cause stress and ill health. The main area of study was the demand–control–support model and, to a certain extent, the effort–reward imbalance model, and how they can be complemented (rather than replaced). Figure 1 illustrates our conceptual framework for the study. “Company” refers to both private and public-sector employers.

As a first step, we concentrated on work and the workplace. In a second step, which falls beyond the scope of this article, we intend to set the demand–control–support model into a wider theoretical context. Bearing in mind the fact that the model does not have a unilaterally individualistic perspective, it seemed appropriate for us to incorporate the model into an organization–sociology theoretical framework, as well as into a psychological one (which can be found on the homepage of *SJWEH Supplements*).

Theoretical assumptions—the demand–control–support model and the effort–reward imbalance model

The following is a brief discussion of the concepts used in the demand–control–support and effort–reward

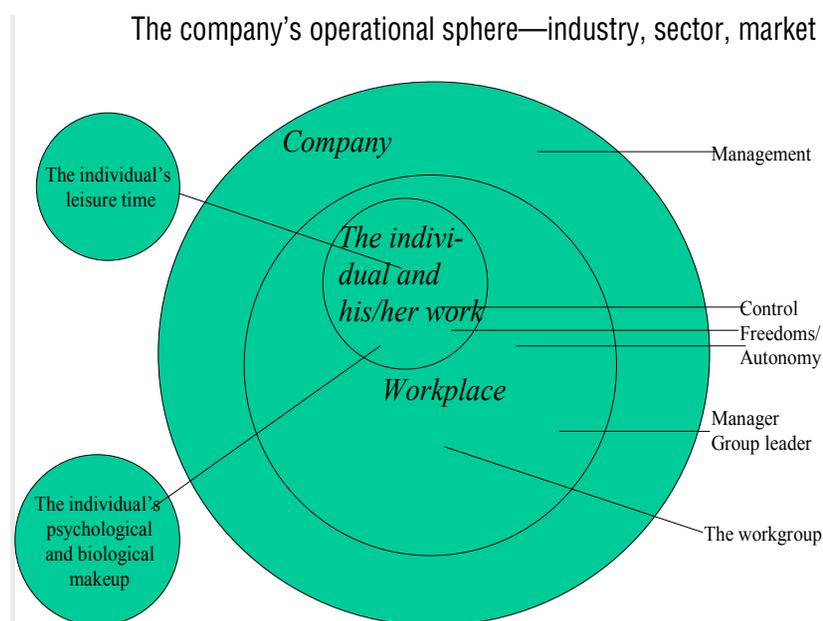


Figure 1. Our conceptual framework.

imbalance models. Rather than being a complete conceptual analysis, our review is meant to show how the concepts have been defined theoretically and how they have been formulated (operationalized) in the questionnaires, since the “practical” operational definitions differed in some respects from the theoretical ones. The results of this review have been used later on in the processing of the qualitative material, in the construction of the new questions, and in the establishment of the new model.

Control. There is a distinction between the theoretical definition of control and how it is formulated (operationalized) in the questionnaires. Karasek & Theorell have defined control as “decision latitude”, which denotes the leeway that the organization gives employees for making their own decisions at work. Decision latitude is made up of two basic components, “authority over decisions”, that is, the employees’ ability to influence *what* is to be done and *how* their own duties are to be carried out, and “skill” (stimulation), how the employees’ personal skills and knowledge are put to use and developed (8, p 58–61). These two aspects are also what the authors call “control at work”. Another more far-reaching aspect of control is what they call “control over work”, which is influence over long-term planning, recruitment, organizational goals, and the like. This difference between the meaning of control by definition and the actual measurement of the concept is illustrated by the following six questions: skill (stimulation): “Do you get to learn new things in your job?”, “Does your work require dexterity?”, “Does your work require ingenuity?”, “Does your work occasionally require you to perform nothing but repetitive tasks?”; authority over decisions: “Are you free to decide *how* your job is to be done?” and “Are you free to decide *what* your job involves?”

This choice of questions can be contested. The scale for measuring control has poor “face validity”, which does not necessarily prevent it from having good empirical validity as a kind of control indicator, however. The apparently disparate phenomena grouped under “control” render the concept difficult to grasp theoretically. For instance, it is a moot point whether control really is a matter of stimulation. The authors see access to competence enhancement at work as something stimulating, and, in doing so, assume that *all* employees see it as such. Yet there is also the possibility that some employees experience it as a stressor and an additional burden if it means having to keep up with new developments in the field. The question about “ingenuity” as a job requirement is another example of an item that seems only loosely related to control, for the employee might also consider ingenuity to be a duty rather than a pleasure.

“Stimulation” should possibly form its own dimension. The link between control and stimulation was

possibly relevant during the age of industrialism and the emergence of Taylorism, but is possibly not so self-evidently applicable to the nonmanual employees and service production of our own times. However, if we see stimulation as a resource factor, which the question “Do you get to learn new things in your job?” suggests, it would be reasonable to treat control as having two components. But skills and knowledge are not the only resources an employee needs to be able to handle certain tasks; personal abilities, money, and machines are examples of resources or means that might also be necessary. We return to this possibility in the results section.

Although “freedoms” as a concept is not included in the theoretical definition of control in the demand–control–support model, the word “freedom” appears in the questions about control, where it is used to describe authority over decisions, although not freedom per se. We are thus able to infer that the authors do not consider freedoms a component of control, but as a qualifier of “authority over decisions”. Therefore, instead of being a dimension in itself in the demand–control–support model, freedom is merely a word used in questions to measure “authority over decisions”. We suggest that “freedoms” should be a separate dimension.

Furthermore, there is, theoretically, an aspect of democracy in what the authors termed “control over work”. However, there are no questions in the operationalization of control that cover this aspect. For instance, there is nothing that deals with the employee’s ability to have a say in the decision-making process, to help devise the organization’s plans, or to obtain information.

Our conclusion—given the preceding discussion—is that the present concept of control may be difficult to use in a workplace inventory since significant aspects are not known. Theoretically, the concept comprises what is termed “control at work” and “control over work”, but along with a number of other dimensions, including “stimulation”, “skills and knowledge”, and “freedoms”. The authors have avoided the problem of these other factors of potential significance by creating a somewhat muddy operational definition of “control”. There are, to repeat, several aspects of the concept that would deserve their own dimensions. Finally, we would also like to note that “authority over decisions”, when operationalized, refers to *work* rather than the *workplace*, dealing rather with the work itself than with the physical or psychosocial space in which it is carried out.

Demands. According to Karasek & Theorell (8), psychological demands have both a quantitative and a qualitative component. The authors see psychological demands as a matter of “workload”, or how “hard, fast and much” an employee works. This work includes, in other words, deadlines, productivity (units per hour), reporting (number per week), as well as conflicting demands.

The following questions are used in the demand-control questionnaire, and they have been compiled into a scale measuring demand: "Does your job require you to work very fast?", "Does your job require you to work very hard?", "Does your job require too much input from you?", "Do you have enough time to complete your job?", and "Does your job often make conflicting demands on you?"

The same criticism can be made of the "demands" questions as of "control". The questionnaire asks, for example, whether the respondent works "fast", "hard" and "much", whether the respondent has a job that requires "much" input, and whether he or she has "enough" time to complete the work. Vague terms like "much" and "very" are likely to produce answers that are equally imprecise. Furthermore, the questions mainly seem to address the demands of physical labor, rather than those more suited to today's work environment, in which psychosocial ill health is predominant.

Kristensen and his colleagues (30) examined the concept of the demand-control-support model for "demands" in their paper "How to Measure Quantitative Demands at Work?" Scales designed to measure quantitative demands at work are highly sensitive to the choice of a specific item. If many items on workplace are included in the scale, several manual professions will be identified as high-demand jobs. If the scale has a preponderance of questions about overtime and long shifts, a completely different picture will be obtained (31).

Theorell et al (32, p 388) agreed that the questions need to be amended to cover psychological work demands and suggested that separate analyses could possibly be used for different social groupings in order to take such demands into account when the demand-control questionnaire is used, since the questions asked can be understood in different ways. Hallqvist et al posited the possibility that the measure of demand is too "woolly" in relation to nonmanual workers and went on to argue that it might not be a problem of quantification but, instead, one of a conceptual vagueness that fails to capture the diversity of "demands" in modern worklife (33, p 1414). Johnson et al have also written that the basic measure of demands ought to be improved (34).

Our conclusion is that the concept of demands needs definitions and questionnaires better suited to modern worklife and today's complex, shifting workplace, since we believe that employees today face demands that are predominantly intellectual, emotional, and social.

Social support. Social support has been defined by Theorell et al (29) and in "Healthy Work: Stress Productivity and the Reconstruction of Working Life" (8) as good relations between employees and between employees and managers. Support is also perceived as having two separate components, one being emotional and the other

instrumental. Emotional support concerns the employee's personal feelings, while instrumental support refers to practical help and relief among employees.

Again, we must differentiate between the concept's theoretical and practical definitions. The support scale applied by the demand-control questionnaire is comprised of the following six statements: "The atmosphere at work is calm and pleasant", "There is a good spirit of unity", "My colleagues are there for me", "People understand that I can have a bad day", "I get on well with my superiors", "I get on well with my colleagues".

The support questions have a distinct emotional tone, and it is hard to see how they encapsulate the instrumental side of support. It is here that theory and operationalization part. The authors' operationalization of "social support" seems very much equivalent to workplace climate. This was also the constructor's intention, but instrumental support is nonetheless absent as a dimension. Furthermore, the questions about "good" spirit and getting on "well" with colleagues, and the like are similar in their lack of precision to those used in the operationalization of demands and control and, likewise, tends to generate responses of dubious accuracy.

The theoretical definition also mentions support both from colleagues and from superiors, but, as regards the latter, there is only one question, whether the employee "gets on well" with his or her manager. This single item could hardly capture the dimension "leadership".

Since the effort-reward imbalance model did not play a significant role in the construction of the new model and new questionnaire, we have placed our discussion on the homepage of *SJWEH Supplements*.

Material and methods

Design and study population

We began our study in 2003 in an attempt to examine the organizational conditions that, directly or indirectly, were affected by social and organizational change, can cause ill health at workplaces, and were not covered by previous psychosocial work-environment models. Our intention was to collate a battery of qualitative material for use in the construction of items for a new questionnaire. The result would then provide the empirical basis for a new descriptive model of the work environment. However, as our resources were very limited, we had to find qualitative material broad enough, but still practicable enough, to achieve our aims.

Our sample population comprised 19 nonmanual workers, male and female, all of whom were participating in existing self-help groups at the Fenix Clearinghouse & Voluntary Centre in Stockholm. All of them

were people who had been seriously affected by radical changes in their work situation (35). Three rounds of focus-group interviews were held with five to seven persons in each group. Two of them were held in the autumn of 2003, the last in February of 2004. Each focus-group interview lasted 2 to 2.5 hours and was concluded when the theme felt exhausted. [See the homepage of *SJWEH Supplements*.]

The theoretical analyses helped us to identify the dimensions, while the conceptual framework gave us a principal structure. [See figure 1.] We were hoping to supplement the individual perspective with a structural perspective, even though we intended to design an individual survey. From the material obtained from the focus-group interviews, the following dimensions emerged: (i) personal performance and profitability, (ii) structure, constant change and organizational instability, (iii) freedoms, (iv) democracy, (v) leadership, and (vi) humanity. The material also contained the dimensions and aspects covered by the demand–control–support and the effort–reward imbalance models.

Widmark's (35) *Det nya arbetslivet* [Modern Work-life]—*en explorativ studie som jämför två dominerande psykosociala arbetsmiljömodeller med aktuell arbetsmiljöproblematik och organisationsförhållanden* presents 97 statements from the informants. The most concentrated, clearest, and most compact of the statements were extracted and reworded into questions and statements not only to identify organizational dimensions, but also to examine how they could be interrelated. Our analysis of the focus-group interviews gave us the principal dimensions and a conceivable (causal) “order” between the dimensions. The informants gave us ideas about how it all fit together.

In order to begin construction of a further complementary questionnaire that would help us describe the overall level of a company or management, we also conducted a case study in a large Swedish high-tech company (36). The results of this study also influenced our construction of the model.

The informants in *Modern Worklife* (35) had previously worked in the health or education sectors, some in the private sector. However, we did not know whether the results would also apply to traditional industrial work or how representative the impression we were given of modern worklife actually was. Focus-group interviews were therefore conducted with nine work-environment inspectors (37), who were divided into two groups. These interviews gave us a more comprehensive picture and generated questions and statements within the earlier identified dimensions. There was nothing to suggest that the material we had previously produced would be irrelevant for industrial workplaces.

It was also obvious early on that the dimensions “leadership” and “structure” were not sufficiently

covered in one interview study (38), based on Widmark's work. Three focus-group interviews were therefore conducted with managers from different industries and sectors in Sweden. The purpose of this study, which took its theoretical source from the work of Weber, Taylor, and Mintzberg, was to examine the impact of organizational structure on health. Management styles, hierarchies, and forces of cohesion were identified as the primary building blocks of organizational structure with a potential effect on health. On the basis of her own work, Thulin Skantze (38) suggested questions and statements to complement those based on Widmark's work (35).

A great deal of research had been done into leadership, much of which has had a psychological orientation. However, research into the correlation between leadership and health is sparse (39). An extensive expert interview with a highly experienced organizational and management consultant revealed two aspects of significance to leadership, namely, what management does and the relationship between the manager and employees. This information generated further items.

Finally other questions and statements were generated from other sources, such as the organizational climate measure (25). In this manner, we finally accumulated a total of 265 suggestions for new questionnaire items.

Some central methodological issues and perspectives around the focus-group interviews in the eight strategically selected groups that, along with the expert interviews and the case study, went to make up the qualitative basis for the development of the new survey are described and discussed in the model, which can be found on the homepage of *SJWEH Supplements*. We believe that the qualitative material expresses opinions and experiences of broad groups in worklife (40, p 141).

The qualitative material was used for the construction of new items. Our perspective was not a psychological one. Our intention was to ask about organizational factors and workplace conditions that we assumed the respondents would recognize and have opinions about. The variables formed the dimensions either alone or in groups. Furthermore, we wanted the respondents to report whether a series of different conditions existed and, if so, to what extent. We considered these conditions to be markers or indicators. The chosen focus of our questions limited possible negative affectivity from the respondents. Although negative affectivity—when we asked more about the actual state of affairs—does not seem to be such a major problem as previous research has indicated (41).

The survey was designed, constructed, and tested in association with the measurement laboratory of Statistics Sweden, where a small sample survey underwent a cognitive test (42). The participants were mainly in nonmanual occupations in organizations with at least 50 employees. Three specially trained interviewers

contacted seven participants and asked them to complete the questionnaire. The participants were then asked their opinions of the different questions, what they thought, how they arrived at a response, and how they finally adapted their response to suit the survey question. The ensuing discussions were recorded and transcribed with annotations and comments by the test leader. Statistics Sweden compiled the participants' comments and added its own assessment. The survey questions were then amended accordingly. The survey was also answered by five researchers at the Institute for Psychosocial Medicine, where the questions were assessed mainly from a scientific perspective. The completed pilot study comprised 25 pages of questions, including 128 new items.

The final survey also contained questions that had already appeared in previous work-environment surveys: organizational justice (Kivimäki, Moorman), conflict resolution (StoraEnso), demand-control questionnaire (Karasek & Theorell), effort-reward (Siegrist), the work-environment survey (AMU), and COPSOQ (the Copenhagen psychosocial questionnaire). As a measure of health and stress symptoms (outcome questions), standard questions were used, from Maslach, the Karolinska sleep questionnaire, and AMU surveys. Newly constructed coping questions and questions that invited the respondent to give "emotional" descriptions of his or her workplace were also included. Finally, the questionnaire also contained several standard questions from Statistics Sweden.

The survey itself was conducted as a postal survey with two reminders. The population comprised healthy men and women at companies with at least 50 employees. The number of persons in the framework population was 1 888 590. But since the RAMS register (a register based on labor market statistics and kept by Statistics Sweden) was not fully up to date, it also contained people who were old-age pensioners or who had taken early retirement and others who had become unemployed or for some other reason were no longer in the labor force. A random population was taken from this framework, which included 518 persons.

The field phase was conducted in August of 2005. Statistics Sweden delivered the dataset in December 2005. The number of respondents was 252, which is 48.6% of the original sample. The average age of the respondents was 46.5 (SD 11.9) years. The nonresponse rate was thus larger than that which normally applies for work-environment surveys carried out by Statistics Sweden; this difference could have been due to the inclusion of people no longer active in the labor market. It is reasonable to assume that the nonresponse rate made the variation lower for different "explanatory variables", but there was still a significant variation among the respondents.

Factor and reliability analysis

After the material was collated, we concentrated on creating more general measures of different theoretical dimensions. As regards the questions based on the demand-control-support and the effort-reward imbalance models, it was considered obvious that we should work from the dimensions and measures used previously, while the new questions required a more thorough analysis. The first step was to group the questions into a number of conceivable dimensions on theoretical and content grounds. [In certain cases, it was clear that the individual variables were to be retained and not merged with others.] The response distribution was examined. Variables with a clearly skewed distribution were removed. Explorative factor analyses were then carried out. Our aim, above all, was to reduce the large number of variables included at the beginning. For example, the initial 25 questions on leadership were finally reduced to 13.

A factor analysis was carried out using the principal components method, in which the factors obtained were rotated with Promax (oblique rotation), which allows the factors to be intrinsically correlated. Internal consistency was calculated with Cronbach's α . A factor loading of 0.3 was generally chosen as the upper threshold of the factor analyses for a variable's accepted loading in another factor. For a variable to be included, a factor loading of 0.6 was generally chosen as the lower threshold. The data were analyzed using SPSS software (version 14, SPSS Inc, Chicago, IL, USA). The factors could not be constructed mechanically, as it was necessary to refer constantly to the meaning of the statements and questions and to juxtapose them with other statements and questions and with the factor as a whole. An empirical measure of the definitive factors was created by taking the mean value of the constituent variables. The initial result was 45 individual variables and variable groups, plus the eight variables describing health and health risks (outcome measures).

Results

Dimensions of the constructed model

Figure 2 presents the 13 dimensions included in the created model. A closer description of the dimensions can be found in section B of the model, which can be found on the homepage of *SJWEH Supplements*. Details of the individual questions and variables, as well as the distribution of received responses can be found in tables B 1.1—1.5 of the model. The results of the factor analyses and Cronbach's α for the created dimensions are also presented in the model.

Workplace factors			
Goals <ul style="list-style-type: none"> • Understanding of the organization's goals • Work targets 	Structure <ul style="list-style-type: none"> • Organizational structure • Organizational properties • Organizational efficiency • Organizational stability • Change in position—flexibility 	Leadership <ul style="list-style-type: none"> • Relations with immediate manager • Immediate manager as coordinator • Management • Type of management—consultative or controlling 	Workplace freedom <ul style="list-style-type: none"> • Freedom to make decisions • Authority
Democracy and justice <ul style="list-style-type: none"> • Manifest freedom of expression • Workplace democracy • Fairness of decision 	Conflict and handling of conflicts <ul style="list-style-type: none"> • Prevalence of conflicts • Conflict resolution 	Humanity and social support <ul style="list-style-type: none"> • Humanity • Profitability and humaneness • Social support 	
Work factors			
Skill discretion <ul style="list-style-type: none"> • Monotonous or developing work 	Work decision authority <ul style="list-style-type: none"> • Ability to decide how the work is to be done • Ability to decide what work is to be done 	Demands <ul style="list-style-type: none"> • Quantitative demands • Emotional demands • Intellectual demands 	Resources <ul style="list-style-type: none"> • Skills, means and decision-making rights • Time for reflection
Outcomes			
Stress symptoms <ul style="list-style-type: none"> • Exhaustion • Burnout • Cognitive disruption • Physical symptoms • Insomnia and restlessness 		Health <ul style="list-style-type: none"> • Sick leave • Self-rated health • Self-rated work capacity 	

Figure 2. The 13 dimensions included in the created model.

Development of a hypothetical “causal” model

To analyze the relationship between the work environment and health or stress symptoms, we then created a hypothetical “causal” model comprised of four main levels. The first included gender and age and was there to control for more fundamental differences in the health or stress symptoms linked with these factors. In all of the analyses, age and gender were controlled, but the relationship with these variables has not been presented since it would have made the results too confusing. It would naturally have been interesting to study the model(s) separately by gender, but doing so was not possible given the small size of the population. As a statistical method, canonical correlation analysis (43) was used. This method has the advantage of enabling studies of correlations between groups of variables. When several variables or factors are included in a dimension, it is thus unnecessary to merge these into a single measure. Calculations of the canonical correlation coefficient between two groups of variables are based on linear combinations of the variables that form part of each factor. These linear combinations are estimated so that the highest, next highest, and so forth correlations are obtained between the two groups. The results can therefore also be considered a form of conditional factor analysis in which the factors are formed on the condition that they correlate as closely as possible with factors in the other group of variables. Using the factor loadings

thus obtained, we were able to determine the part played by individual variables in the correlation. These factor loadings were also an important basis for the interpretation of the connections that might be at hand.

It is important to stress the explorative nature of the method. No assumptions were made from the beginning about the strength of the connections. At a fundamental level there were simply assumptions about the causal order between the levels in the model. The results of the analysis have been presented in the form of partial correlation coefficients (Pearson's). The canonical correlation coefficient obtained describes the strength of the correlation between two dimensions when controlled for the effects of all the dimensions (eg, the variables) on the same or earlier levels. Calculations were made for all possible connections between all of the dimensions in the model.

We based the assessment of our results on the structure as a whole, and whether it seemed logical and meaningful, and on the explained variance in the model, partly as regards the extent to which the model as a whole could explain the variance in the result and partly as regards the extent to which the different levels of the model could explain it. Our attempt to integrate the effort–reward imbalance model into our model was not successful. The different stages of the analyses and the results they produced can be found in note 6 of the model (which can be found on the homepage of *SJWEH Supplements*).

After several modifications, we obtained a relatively clear structure. The model had two centers, “demands” and “humanity and social support”, but the relationship between the levels of the workplace and work was complicated, probably because variables at the workplace level did not end up in the proper dimensions; therefore certain adjustments were made. The final model is presented in figure 3. To aid comprehension, only the correlation coefficients that were significant at a 5% level or lower have been shown.

In addition to age and gender, the final model contained 78 completely new “modern worklife” questions. Also included in the model were 17 questions from the demand-control questionnaire, 7 questions about “organizational justice”, 3 questions from the Stora Enso study, 1 question from the COPSOQ, and 21 established outcome items dealing with stress symptoms and health. The final model comprised 13 dimensions.

Finally, we also carried out an analysis that controlled for social class. This variable was constructed of one question about educational level and one about role or status within the organization (blue-collar, white-collar, manager). The structure was affected only marginally, however.

The model

The model can be seen as an expansion of the demand-control-support model, complemented and reinforced

with variables that give a broader description of work and the workplace. Figure 3 shows the results that remained after various modifications.

The model had two hubs or centers, namely, the dimensions “humanity and social support” and “demands” (figure 3). This result suggests that we were dealing with two aspects of organization: a *soft* aspect, which resides in the “humanity and social support” factor, and a *hard* aspect, which describes all of the other dimensions of work and the workplace.

Of the four dimensions describing work (stimulation, authority over decisions, demands, and resources), demands was the only one that established direct, significant links with the two outcome measures stress symptoms and health (figure 3).

Of the seven dimensions describing the workplace (goals, structure, management, freedoms, democracy, conflicts and conflict management, and humanity and social support), “humanity and social support” was the only one that established direct, significant links with the health outcomes (figure 3).

There were direct links between the dimension “demands” and all of the other dimensions describing work, and with the dimension “freedoms” (figure 3), which had been placed at the workplace level. The “demands” dimension thus seemed to incorporate much of what is important as regards work.

The “humanity and social support” dimension evinced direct significant links with the dimensions

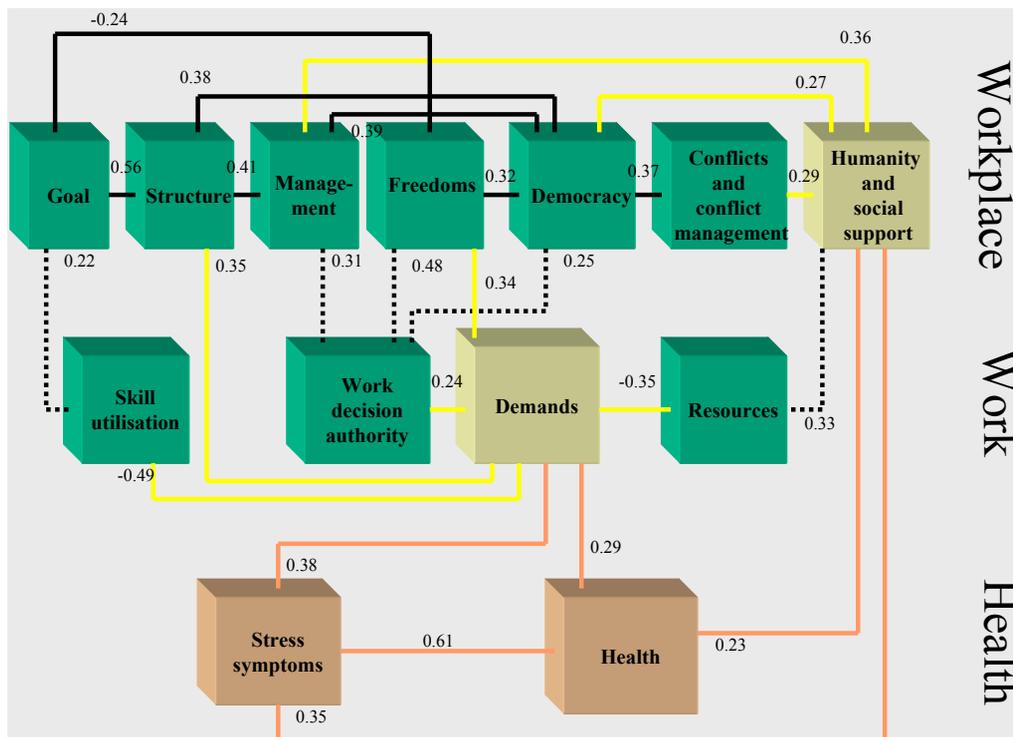


Figure 3. A hypothetical “causal model”.

“management”, “democracy”, and “conflicts and conflict management” (figure 3) and thus seemed to take a central position in descriptions of the workplace.

The three dimensions “management” (with its links to the “structure” factor), “freedoms”, and “democracy” were all clearly linked with the dimension “work decision authority” (figure 3) and thus were even more connected with the levels of the workplace and work. The dimension “work decision authority” was then placed in a context that could create a better understanding of the concept, in that we were able to ascertain the factors with which “work decision authority” correlated.

In the design of a new job content questionnaire, the term “macro-decision latitude” was used. It is possible that the model would have gained from the merger of these four dimensions under the heading “control”. We did not carry out such a merger, however, as it would have meant that the categorization into workplace and work, which was fundamental to the design of the model, would have been eliminated. Further analyses in this respect are desirable.

The workplace factors were also closely connected (figure 3).

The results further showed that there was a clear link between the workplace and work levels. All of the dimensions describing the workplace (except for “conflicts and conflict management”) displayed direct, significant correlations with one or more of the dimensions describing work.

To summarize, the factors of work and the workplace had an impact on the employees’ stress symptoms and health through the demands of work. However, workplace factors did not only operate through work demands but also through the dimension “humanity and social support”, which had an immediate effect on the employees’ stress symptoms and health.

The “employment security” and “effort–reward” dimensions were difficult to fit into the model. All in all, they added very little to the explanatory variance of the model as regards the outcome. Therefore, we did not include them in the final model. We also found that, if we used only the original demand–control–support variables (questions), the model was considerably weakened and appeared to be more incoherent.

The total explained variance of the model was 42.2% for the stress symptom factor (ie, the stress-related health outcome). On the basis of the “causal assumptions” of the model, the dimensions describing work and the workplace accounted for 13.7% and 28.5%, respectively. If we consider the “health” outcome, the total explained variance was 11.2%, for which work and the workplace accounted for 5.0% and 6.2% respectively.

The results suggested that we would be able to obtain a more complete picture of the relationship between the work environment and health if the measures used

to date were supplemented with new ones describing modern worklife. The model might also have benefited from being complemented with additional dimensions and perhaps a new level describing the workgroup.

It is important here to note two things. First, the model is hypothetical, intended as the basis for a discussion on how a model for the analysis of the relationship between the work environment and health could be designed. Second, the study group was small, which seriously undermined the reliability of our assessment of individual correlations and the degree of explanation of the model. Nevertheless, we would like to assert that the introduction of new variables not only improved explanations of the health situation (the explanatory variance increased when the new items were included), but perhaps more importantly also gave a greater understanding of how the conditions of a work environment can have an impact on human health.

Longitudinal database

The participants in the Swedish work-environment survey (AMU) in 2003 were followed up in early March of 2006, 2 months after the delivery of data from “modern worklife”. [A second follow-up was conducted at the beginning of 2008, and a third is planned for the beginning of 2010.] In addition to the AMU questions, the survey contained work-environment questions used in other contexts. About a quarter of the survey questions came from our investigation, a selection of 70% of the new questions on modern worklife used in the model. This use made it possible to test the model further on a much larger material base. The survey for the national longitudinal database SLOSH (Swedish longitudinal occupational survey of health) had 5412 respondents. In the 2008 follow-ups, practically all of the new worklife questions were included.

SLOSH lacked all of the variables included in our “goals” factor. The “structure”, “management”, and “freedoms” factors contained a greatly reduced number of variables. The “humanity and social support” factor contained only questions from the demand–control questionnaire (ie, social support). There were also fewer variables in the “resource” factor. Despite these differences, a similar structure appeared when the now reduced model was tested with this larger material base.

We included only the correlations that were significant on a P-level of 0.001 and those that were greater or equal to 0.15. In two cases, lower correlations were included (figure 4). The most striking difference was found in the correlations between “social support” and the outcome factors, which were low and nonsignificant. This result corroborated our previous finding that the “humanity” and “profitability” components played a key part in this dimension. Overall, this reduced model

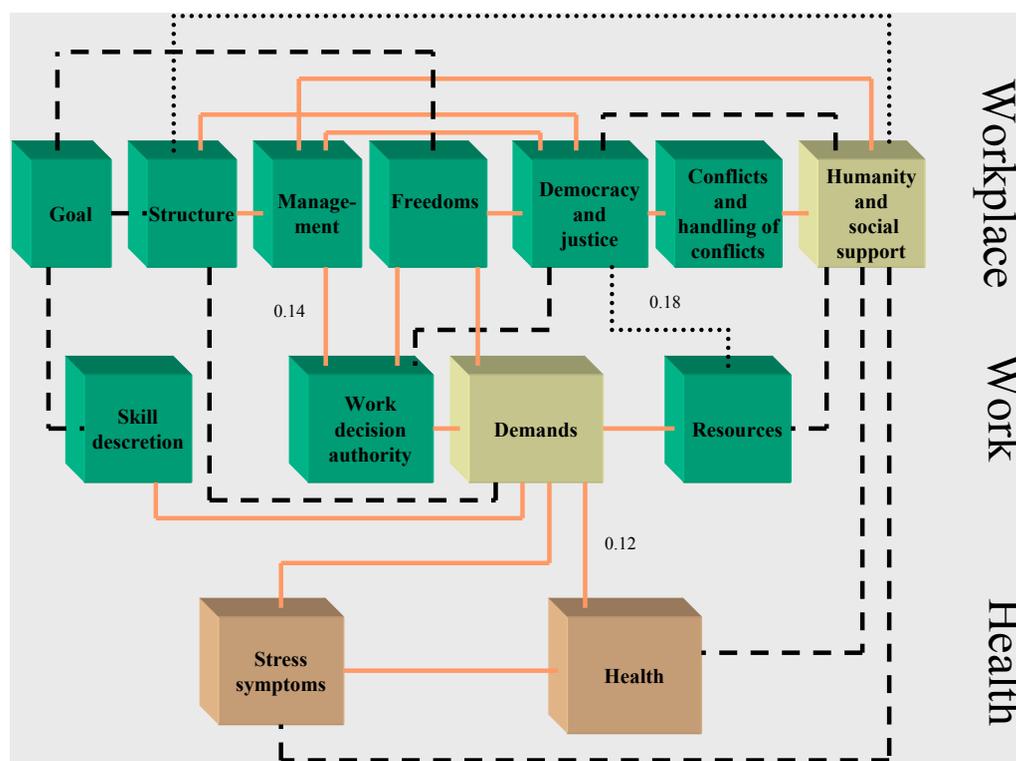


Figure 4. A comparison between the “hypothetical causal model” in the pilot study and the SLOSH (Swedish longitudinal occupational survey of health) database. [solid lines = connections found both in the pilot study and in SLOSH, broken lines = connections found only in the pilot study, dotted lines = connections found only in SLOSH).

explained 28.6% of the variation in stress symptoms and 9.1% of the variation in health. The degree of explanation was greatly reduced, possibly because the study group was larger.

Discussion

The results of the study indicate the importance of formulating new ideas and hypotheses about the effects of work and the workplace on human health. In our view, therefore, the study contributes to the development of work-environment research and the systematic improvement of workplace conditions. On the basis of these results, we have been able to develop a new questionnaire for mapping the psychosocial work environment, in which the “individual achievement and profitability” factor has been expanded, the “leadership” and “demands and resources” items have been updated and developed, and questions about “employment security”, “mobbing”, “conflict and conflict management”, and the “work-leisure relationship” were added. To this new questionnaire it is also possible to attach a complementary one dealing with the physical work environment.

An additional instrument for probing the work environment is currently under construction, this time

directed towards managers and other persons in leading positions. We hope in this way to uncover organizational and structural conditions that may importantly (but perhaps invisibly) affect the psychosocial work environment.

Our hope is that our questions will stimulate the respondents’ ideas that allow them to really view their workplace with new eyes and that they can then, in turn, establish an open forum for the discussion of their problems and how they can be resolved.

Acknowledgments

We are deeply indebted to Töres Theorell, Professor Emeritus, Karolinska Institutet, without whose own inspiring research, tolerance regarding the focus of our study, and generous support this project would not have been possible. We are hugely appreciative of the many helpful suggestions and comments offered, which have greatly contributed to the quality of this paper. We would also like to thank Neil Betteridge (NBb Translations), Jane Ferrie (University College London), Birgit Henningson (Statistics Sweden), Sara Hoff (Statistics Sweden), Martin Hyde (University College London), Jeff Johnson (University of Maryland School

of Nursing), Lillemor Katz (Stress Research Institute, Stockholm University), Göran Käcklund (Stress Research Institute, Stockholm University), Michael Nilsson, (Statistics Sweden), Eleanor Rapier (Stockholm University), and Anders Risling (Provins fem), Eva Thulin Skantze (Swedish Association of Local Authorities and Regions).

References

1. SCB Arbetskraftsundersökning AKU. 1990–1993.
2. SCB Registerbaserad arbetsmarknadsstatistik enligt AMPAK 2004. SCB. 2006.
3. Palmer E. Sjukskrivning och förtidspension de närmaste åren. In: Marklund S, Bjurvald M, Hogstedt C, Parmer E, Theorell T, editors. Den höga sjukfrånvaron—problem och lösningar. Stockholm: Arbetslivsinstitutet, Försäkringskassan, Institutet för psykosocial medicin och Statens Folkhälsoinstitut; 2005. p 17–38.
4. Theorell T. I spåren av 90-talet [In the tracks of the 1990's]. Stockholm: Karolinska University Press; 2006.
5. Hurrell JJ Jr, Nelson DL, Simmons BL. Measuring job stressors and strains: where we have been, where we are, and where we need to go. *J Occup Health Psychol.* 1998;3(4):368–89.
6. Härenstam A, Wiklund P. Vad kännetecknar och innebär moderna arbets- och livsvillkor?: resultat och analyser med personalansats samt utveckling av analysmodeller för befolkningsstudier [What is typical of modern working and living conditions and what do they signify?: results and analyses from a staff perspective and a development of analytical models for population studies]. Stockholm: Stockholms Läns Landsting; 1999. Rapport från Yrkesmedicinska enheten, 8.
7. Karasek RA. Job demands, job decision latitude, and mental strain: implications for job redesign. *Adm Sci Q.* 1979;24:285–308.
8. Karasek R, Theorell T. Healthy work: stress, productivity and the reconstruction of working life. New York (NY): Basic Books; 1990.
9. Johnson JV. Control, collectivity and the psychosocial work environment. In: Sauter S, Hurrell J, Cooper C, editors. Job stress and work control. London: Wiley; 1989. p 55–74.
10. Johnson JV, Hall EM. Job strain, workplace social support and cardiovascular disease: a cross-sectional study of a random sample of the Swedish working population. *Am J Public Health.* 1988;78(10):1336–42.
11. Siegrist, J. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol.* 1996;1(1):27–41.
12. Kompier M. Job design and well-being. In: Schabracq MJ, Winnubst JAM, Cooper CL, editors. The handbook of work and health psychology. New York (NY): John Wiley & sons Ltd; 2003.
13. Landsbergis P, Theorell T. Measurement of psychosocial workplace exposure variables. In: Schnall PL, Belkić K, Landsbergis P, Baker D, editors. Occupational medicine: the workplace and cardiovascular disease. Philadelphia (PA): Hanley & Belfus; 2000.
14. Kivimäki M. Organizational justice—any impact on employee's health? Individual Abstract Number 1721 from The American Psychosomatic Society 65th Annual Meeting in Budapest, Hungary. March 7–10, 2007.
15. Theorell T, Oxenstierna G, Westerlund H, Ferrie JE, Alfredsson L. Downsizing of staff lowers long term sick leave in female employees with high cardiovascular risk. *Occup Environ Med.* 2003;60:e9 (<http://www.occenvmed.com/cgi/content/full/60/9/e9>)
16. Marmot M, Siegrist J, Theorell T. Health and the psychosocial environment at work. In: Marmot M, Wilkinson RG, editors. Social determinants of health. Oxford: Oxford University Press; 2006. p 97–130.
17. Oxenstierna, G. Socialtjänstens förutsättningar för barnavårdsarbete—en studie om villkor, påfrestningar och resultat. Doktorsavhandling [On conditions of work with child welfare families within the social services—a study of obstructions, job strains, goal fulfilment and client satisfaction; dissertation]. Stockholm: Institutionen för socialt arbete—Socialhögskolan, Stockholms universitet; 1997.
18. Szücs S, Hemström Ö, Marklund S. Organisatoriska faktorer betydelse för långa sjukskrivningar i kommuner [The importance of organisational factors for long-term sick-listing in municipalities]. Stockholm: Arbetslivsinstitutet; 2003. Vetenskaplig skriftserie 2003:6.
19. Härenstam A, Rydbeck A, Karlkvist M, Waldenström K, Wiklund P. The significance of organisation for healthy work—methods, study design, analysing strategies and empirical results from the MOA-study. Stockholm: Arbetslivsinstitutet; 2004. Arbete och hälsa 13.
20. Vahtera J, Kivimäki M, Pentti J, Theorell T. Effects on change in the psychosocial environment on sickness absence: a seven year follow up on initially healthy employees. *J Epidemiol Community Health.* 2000;54:484–93.
21. Westerlund H, Ferrie J, Hagberg J, Jeding K, Oxenstierna G, Theorell T. Workplace expansion, long-term sickness absence, and hospital admission. *Lancet* 2004;363(9416):1193–7.
22. Westerlund H. Health changes in a changing labour market [dissertation]. Stockholm: Karolinska Institutet, Department of Public Health Sciences, Division of Psychosocial Factors and Health; 2005.
23. Akerboom S, Maes S. Beyond demand and control: the contribution of organizational risk factors in assessing the psychological well-being of health care employees. *Work Stress.* 2006; 20(1): 21–36.
24. Parker SK, Wall TD, Cordery JL. Future work design research and practice: towards an elaborated model of work design. *J Occup Org Psychol.* 2001;74(4):413–40.
25. Patterson GP, West MA, Shackleton V J, Dawson JF, Lawthom R, Maitlis S, Robinson DL, Wallace AM. Validating the organizational climate measure: links to managerial practices, productivity and innovation. *J Org Behav.* 2005;26,(4):379–408.
26. Brenner S-O, Levi L. Long-term unemployment among women in Sweden. *Soc Sci Med.* 1987; 25:153–61.
27. Zapf D. Emotion work and psychological well-being: a review of the literature and some conceptual considerations. *Hum Resour Manage Rev.* 2002;12:237–68.
28. Bond FW, Bunce D. Job control mediates change in work organization intervention for stress reduction. *J Occup Health Psychol.* 2001;6: 290–302.
29. Theorell T, Oxenstierna G, Westerlund H, Ferrie J, Hagberg J, Alfredsson L. Downsizing of staff is associated with lowered medically certified sick leave in female employees. *Occup Environ Med.* 2003;60(9):E9.
30. Kristensen TS, Hannerz H, Högh A, Borg V. The Copenhagen psychosocial questionnaire—a tool for assessment and improvement of the psychosocial work environment. *Scand J Work Environ Health.* 2005;31(6):438–49.

31. Kristensen TS, Bjorner JB, Christensen KB, Borg V. The distinction between work pace and working hours in the measurement of quantitative demands at work. *Work Stress*. 2004;18(4):305–22.
32. Theorell T, Tsutsumi A, Hallqvist J, Reuterwall C, Hogstedt C, Fredlund P, Emlund N, Johnson JV, the SHEEP Study Group. Decision latitude, job strain, and myocardial infarction: a study of working men in Stockholm. *Am J Public Health*. 1998;88:382–8.
33. Hallqvist J, Diderichsen F, Theorell T, Reuterwall C, Ahlbom A, SHEEP Study Group. Is the effect of job strain on myocardial infarction risk due to interaction between high psychological demands and low decision latitude?: results from Stockholm heart epidemiology program (SHEEP). *Soc Sci Med*. 1998;46(11):1405–15.
34. Johnson JV, Stewart W, Hall EM, Fredlund P, Theorell T. Long-term psychosocial work environment and cardiovascular mortality among Swedish men. *Am J Public Health*. 1996; 86(3):324–31.
35. Widmark M. Det nya arbetslivet—En explorativ studie som jämför två dominerande psykosociala arbetsmiljömodeller med aktuell arbetsmiljöproblematik och organisationsförhållanden [The new working life—an explorative study comparing two dominating psychosocial work environment models with contemporary work environment issues and organisational conditions]. Stockholm: Institutet för psykosocial medicin—IPM; 2005. Stressforskningsrapporter nr 315.
36. Finnholm K. Efter taylorismen: organisationsstruktur och ledarskap i ett svenskt högteknologiskt storföretag—en explorativ fallstudie [After taylorism: organisational structure and leadership in a major Swedish high-technology enterprise—an explorative study]. Stockholm: Stressforskningsinstitutet; 2008.
37. Widmark M. Arbetsplatsförhållanden och hälsa—två fokusgruppsintervjuer med arbetsmiljöinspektörer i Örebro: bandutskrift [Workplace conditions and health—two focus group interviews with work environment inspectors in Örebro; transcription from recordings]. Örebro: Örebro Universitet; 2005.
38. Thulin Skanze E. Organisationsstrukturens betydelse för de anställdas hälsa: en explorativ studie baserad på fokusgruppsintervjuer bland chefer [The importance of organisational structure for employee health—an explorative study based on focus group interviews with managers]. Stockholm: Institutet för psykosocial medicin—IPM; 2006. Stressforskningsrapporter nr 318.
39. Nyberg A, Bernin P, Theorell T. The impact of leadership on the health of subordinates. Stockholm: Arbetslivsinstitutet; 2005. SALTSA—working life research in Europe 2005:1.
40. Waterton C, Wynne B. Can focus groups access community views? In: Barbour RS, Kitzinger J, editors. *Developing focus group research: politics, theory and practice*. London: SAGE; 1999.
41. Williams LJ, Gavin MB, Williams ML. Investigating measurement and non-measurement processes with method effect variables: an example with negative affectivity and employee attitudes. *J Appl Psychol*. 1996;81:88–101.
42. SCB Undersökning om ”det nya arbetslivet”: pilot [“The new working life”: a Statistical Sweden pilot survey]. Stockholm: Statistics Sweden; 2006. Teknisk rapport Enkätenheten 01 27.
43. Thompson B. *Canonical correlation analysis: uses and interpretation*. Beverly Hills (CA): Sage; 1988.
44. Miller P, Rose N. *Production, identity, and democracy*. *Theory Soc*. 1995;24(3):427–67.
45. Honneth A. *Erkännande: praktisk-filosofiska studier* [Studies in practical philosophy]. Göteborg: Daidalos; 2003.
46. Ahne G. *Agency and organization: towards an organizational theory of society*. London: Sage; 1990.
47. Ahne G. *Social organizations: Interaction inside, outside and between organizations*. London: Sage; 1994.
48. Merton R K, Fiske M, Kendall PL. *The focused interview, a manual of problems and procedures*. Glencoe (IL): Free Press; 1956.
49. Morgan D L. Focus groups. *Ann Rev Soc*. 1996;22:129–52.
50. Puchta C, Potter J. *Focus group practice*. London: Sage; 2004.
51. Bohnsack R. Group discussions and focus groups. In: Flick U, von Kardorff E, Stenke I, editors. *A companion to qualitative research*. London: Sage; 2004.