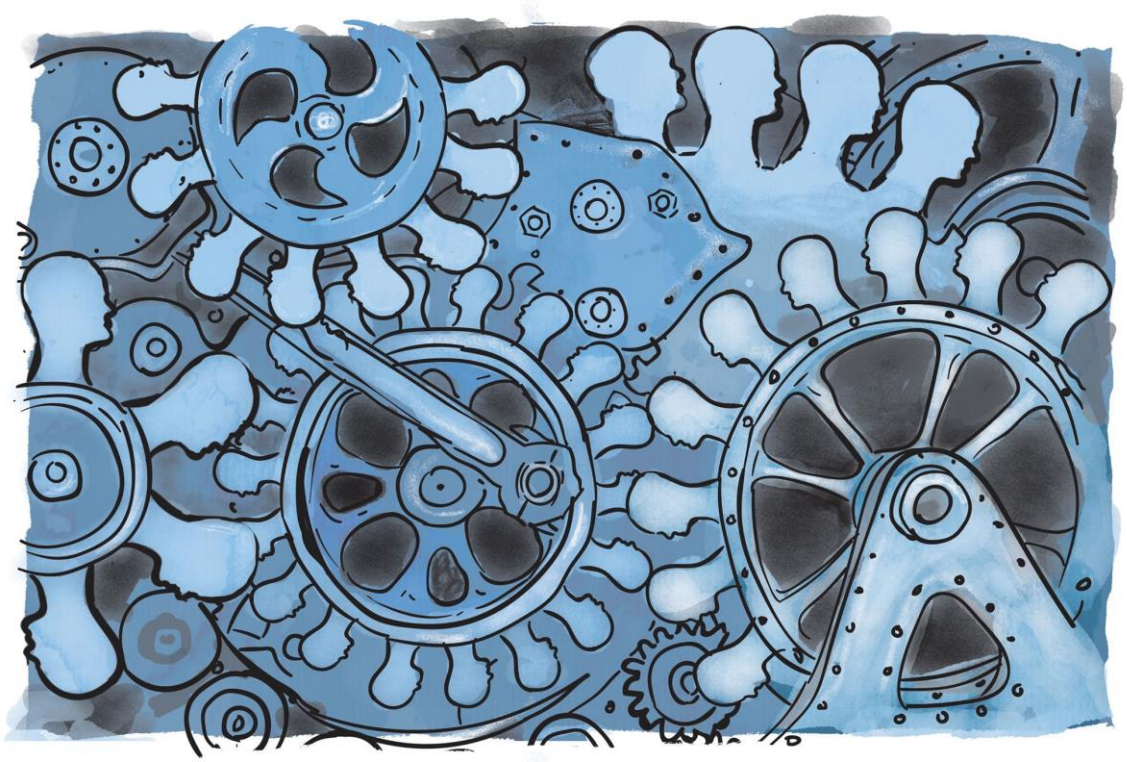
UNIVERSITY OF COPENHAGEN
FACULTY OF HEALTH AND MEDICAL SCIENCES

Organizational Change at Work, Employee Turnover, and Health

- a longitudinal study among employees in the Capital Region of Denmark



Johan Høy Jensen

PhD thesis

This thesis has been submitted to the Graduate School of Health and Medical Sciences, University of Copenhagen

November 29, 2018

Organizational Change at Work, Employee Turnover, and Health

- a longitudinal study among employees in the Capital Region of Denmark

Johan Høy Jensen

PhD thesis

Graduate School of Health and Medical Sciences,
University of Copenhagen

Department of Occupational and Environmental Medicine,
Bispebjerg University Hospital

2018

Author: Johan Høy Jensen, MSc in Psychology
Department of Occupational and Environmental Medicine
Bispebjerg University Hospital, Denmark

Academic advisors: Jens Peter Bonde, MD, PhD, DMSc, Professor
Department of Occupational and Environmental Medicine
Bispebjerg University Hospital, Denmark

Naja Hulvej Rod, PhD, DMSc, Professor
Department of Public Health
University of Copenhagen, Denmark

Esben Meulengracht Flachs, PhD
Department of Occupational and Environmental Medicine
Bispebjerg University Hospital, Denmark

Janne Skakon, PhD, External Associate Professor
Department of Psychology
University of Copenhagen, Denmark

Assessment Committee: Kirsten Nabe-Nielsen, PhD, Associate Professor (Chair)
Faculty of Health and Medical Sciences
University of Copenhagen, Denmark

Jussi Vahtera, MD, PhD, Professor
Department of Public Health
University of Turku, Finland

Johan Hviid Andersen, MD, PhD, Professor
Department of Occupational Medicine
Regional Hospital West Jutland, Denmark

Submitted on: November 29, 2018
Defended on: February 15, 2019

ISBN: 978-87-970125-3-6
Cover illustration: Nicolai Bruun

Preface and acknowledgements

This PhD thesis was conducted at the Department of Occupational and Environmental Medicine at Bispebjerg University Hospital, Copenhagen, Denmark, in the period December 2015 through November 2018. From February to June 2018, I was a visiting research scholar at the Department of Social and Behavioral Sciences (SBS) at Harvard T. H. Chan School of Public Health, Harvard University, Boston, MA, USA.
This work was funded by the Danish Working Environment Research Fund (grant number: 13-2015-03). My research stay abroad was financially supported by University of Copenhagen, Julie von Müllens Fond, Else & Mogens Wedell-Wedellsborgs Fond, and the Graduate School of Public Health, University of Copenhagen.

My time as a PhD fellow during the past three years has truly been a tremendous experience – both in terms of educational and personal growth. The subject of organizational change and employee outcomes branches into several academic disciplines, which has given me the opportunity to work with an interdisciplinary team of exceptionally talented people to whom I would like to express my gratitude.

My deepest gratitude goes to my principal supervisor, Professor Jens Peter Bonde. Thanks for sharing your brilliant insights and for supporting me through the phases of my PhD project. I have immensely appreciated your contagious enthusiasm and down-to-earth approach. Your supervision style will undeniably inspire me in my future work.

I would also like to express my sincere thanks to you, Professor Naja Hulvej Rod, for your original public-health perspectives and insightful comments on the subject. Your ambitious attitude and high research standards have widened my horizons within psychosocial epidemiology.

I am especially appreciative of you, Dr. Esben Meulengracht Flachs, for your never-failing attempts to explain the logics of the most complex statistical methods. This PhD thesis would not have been possible without your vast knowledge and pedagogical approach to share it.

I also extend my gratitude to you, fellow psychologist Dr. Janne Skakon. Thanks for your valued inputs on theoretical and interventional perspectives. Our inspiring discussions have provided me with a broader understanding of the complexities involved in the subject.

To Professor Ichiro Kawachi and everyone in Department of Social and Behavioral Sciences: Many thanks for warmly welcoming me in your research group, your time and effort in academic supervision, and for your highly appreciated feedback on my work. My stay with your research group is one of my fondest memories during this PhD project.

I would also like to thank the working group on the *Well-being in Hospital Employees* (WHALE) cohort, and particularly Charlotte Hyldtoft and Dr. Jesper Strøyer Andersen from the Capital Region of Denmark, for insights and knowledge about the data.

Thanks to the co-authors of Papers I-VI for your collaboration, your valuable ideas, and for making this PhD thesis possible.

My gratitude also goes to my fantastic – present as well as former – colleagues in Department of Occupational and Environmental Medicine at Bispebjerg University Hospital. You all make our department to the best workplace in the world!

My parents, my brother, family, and my friends; thank you all for your emotional and spiritual support throughout this PhD project and for counterweighting an intensive working life.

Last but not least, I would like to heartfully thank you, my dear Nina, for your love, unconditional support, and forbearance with my physical and mental absence from time to another through the past three years.

Johan Høy Jensen

Copenhagen, November 2018

This PhD thesis is based on the following Papers:

Paper I (published)

Hvidtfeldt UA, Bjorner JB, Jensen JH, Breinegaard N, Hasle P, Bonde JP, Rod NH. Cohort profile: the well-being in hospital employees (WHALE) study. *Int J Epidemiol*, 2017;**46**(6):1758-1759h. doi:10.1093/ije/dyx073

Paper II (published)

Jensen JH, Flachs EM, Skakon J, Rod NH, Bonde JP. Dual impact of organisational change on subsequent exit from work unit and sickness absence: a longitudinal study among public healthcare employees. *Occup Environ Med*, 2018;**75**(7):479-485. doi:10.1136/oemed-2017-104865

Paper III (in press)

Jensen JH, Flachs EM, Skakon J, Rod NH, Bonde JP. Longitudinal associations between organizational change, work-unit social capital, and employee exit from the work unit among public healthcare workers: a mediation analysis. *Scand J Work Environ Health*, 2019;**45**(1):53-62, online first [21-Aug-2018]. doi:10.5271/sjweh.3766

Paper IV (published)

Breinegaard N, Jensen JH, Bonde JP. Organizational change, psychosocial work environment, and non-disability early retirement: a prospective study among senior public employees. *Scand J Work Environ Health*, 2017;**43**(3):234-240. doi:10.5271/sjweh.3624

Paper V (in press)

Jensen JH, Bonde JP, Flachs EM, Skakon J, Rod NH, Kawachi I. Work-unit organizational changes and subsequent prescriptions for psychotropic medication: a longitudinal study among public healthcare employees. *Occup Environ Med*, accepted [28-Nov-2018]. doi:10.1136/oemed-2018-105442

Paper VI (submitted)

Jensen JH, Flachs EM, Skakon J, Rod NH, Bonde JP, Kawachi I. Work-unit organizational changes and risk of ischemic heart disease: a prospective study of public healthcare employees in Denmark. *BMJ Open*

Contents

Abbreviations

ATC	Anatomical Therapeutic Chemical classification system
CI	Confidence Interval
COPSOQ-II	Copenhagen Psychosocial Questionnaire, 2nd version
DREAM	*Den Registerbaserede Evaluering Af Marginalsamfundet*
EFW	Exit From the Work unit
HR	Hazard Ratio
ICD-10	International Classification of Diseases, 10th revision
IHD	Ischemic Heart Disease
MSA	Measure of Sampling Adequacy
OR	Odds Ratio
RR	Rate Ratio
SA	Sickness Absence
SD	Standard Deviation
WHALE	Well-being in Hospital Employees
WHO	World Health Organization
WSC	Work-unit Social Capital
ZIP	Zero-Inflated Poisson

Resumé på dansk

Baggrund: Organisatoriske ændringer på arbejdspladsen er almindelige og bliver ofte iværksat for at imødekomme krav om øget produktivitet og bedre service. Imidlertid lader der til at være en pris at betale for de berørte ansatte. En stigende mængde forskning konkluderer, at organisatoriske ændringer har en negativ indflydelse på det psykosociale arbejdsmiljø, og studier indikerer højere personaleomsætning og øget risiko for dårligt medarbejderhelbred efter sådanne ændringer. Tidligere forskning i medarbejderkonsekvenser af organisatoriske ændringer har hovedsagelig fokuseret på større omstruktureringer i virksomheder eller personalenedskæringer. Denne afhandling evaluerer indflydelsen af specifikke former for organisatoriske ændringer i arbejdsenheden for efterfølgende personaleomsætning (dvs. medarbejder-exit fra arbejdsenheden og efterløn) og medarbejderhelbred (dvs. sygefravær, udskrivelse af psykofarmaka og incident iskæmisk hjertesygdom). Den medierende (forklarende) betydning af specifikke psykosociale faktorer blev vurderet for associationer med medarbejder-exit fra arbejdsenheden og iskæmisk hjertesygdom. Potentielle køns- og tidmæssige forskelle blev undersøgt i relation til udskrivelse af psykofarmaka som udfald.
Metoder og materialer: To arbejdsmiljøundersøgelser blev udført i perioderne fra 12. januar til 9. februar 2011 (*N*=35.560; 81% svarede) og gennem hele marts 2014 (*N*=37.720; 84% svarede) blandt alle ansatte i Region Hovedstaden. Et selv-rapporteret item målte oplevet stress. Mål for social kapital, ledelseskvalitet og organisatorisk retfærdighed aggregeret på arbejdsenheds-niveau var baseret på 16 selv-rapporterede items. I 2013 og 2016 gav lederne information om hændelse af specifikke former for organisatoriske ændringer i deres arbejdsenhed mellem januar 2009 og marts 2011 (69% svarede) samt for hvert semester i 2013 (59% svarede): sammenlægninger, opsplitninger, flytning, lederskifte (kun for perioden 2009-2011), afskedigelse af medarbejdere og selektive besparelser. Referencegrupperne omfattede ansatte, der ikke var eksponeret for nogen organisationsændringer. Data på medarbejder-exit fra arbejdsenheden, total og langtidssygefravær (≥29 dage), udskrivelse af psykofarmaka (anxiolytica [ATC-kode: N05B], hypnotica/sedativa [N05C], antidepressiva [N06A]), og iskæmisk hjertesygdom (ICD-10: I20-I25) i 2014 samt overgang til efterløn mellem 2011-2012 blev udtrukket via opkobling til regionale løn- og nationale forskningsregistre. Logistisk-, *zero-inflated Poisson*- og overlevelses-regressionsanalyser analyserede sammen med multilevel teknikker relationer mellem organisationsændringer i 2013 og personaleomsætning/medarbejderhelbred i 2014 (Paper II-III og V-VI) samt mellem organisationsændringer i 2009-2011 og efterløn i 2011-2012 (Paper IV).

Resultater: Denne afhandling anvendte data fra WHALE-kohorten (*Well-being in Hospital Employees*) og en kohorteprofil blev publiceret til referenceformål (Paper I). Nogle indikatorer på organisatoriske ændringer, men ikke alle, var forbundet med 10-50% højere rater for medarbejder-exit fra arbejdsenheden og overgang til efterløn relativt til ingen ændringer (Papers II-IV). Organisatoriske ændringer var konsistent forbundet med 90-270% højere relative risiko for lav social kapital i arbejdsenheden. Der var en omvendt dosis-responssammenhæng mellem lavere social kapital i arbejdsenheden og højere medarbejder-exit fra arbejdsenheden. Associationen mellem organisatoriske ændringer og medarbejder-exit fra arbejdsenheden blev ikke reduceret nævneværdigt ved justering for social kapital i regressionsmodellen (Paper III). Ganske vist blev associationen med efterløn i nogen grad reduceret ved samtidig justering for arbejdsenhedens sociale kapital, ledelseskvalitet og organisatorisk retfærdighed (Paper IV). I forhold til ingen ændringer var eksponering for organisationsændringer associeret med op til 40% højere risiko for sygefravær eller udskrivelse af psykofarmaka i det følgende år blandt ansatte uanset køn. Sammenhængene med psykofarmaka var stærkest for ledelsesskift og for udskrivelser i sidste semester af den 12 måneder lange opfølgningsperiode (Papers II og V). Eksponering for flytning, lederskifte og afskedigelse i arbejdsenheden var forbundet med 120-190% højere risiko for incident iskæmisk hjertesygdom blandt ansatte i det følgende år sammenlignet med ingen ændringer. Justering for oplevet stress mindskede ikke disse risikoestimater nævneværdigt (Paper VI).
Konklusioner: Organisatoriske ændringer i arbejdsenheden var longitudinelt associeret med højere rater for efterfølgende personaleomsætning og højere risici for dårligt helbred blandt ansatte i forhold til ingen ændringer. Der var ingen overbevisende indikationer på at specifikke former for organisatoriske ændringer var særligt associeret med samtlige af de undersøgte medarbejderudfald, om end ændringer, der involverede afskedigelse af ansatte, var mere konsistent associeret med højere relativ risiko for dårligt medarbejderhelbred. Arbejdsenhedens sociale kapital forklarede ikke de inkonsistente sammenhænge mellem organisatoriske ændringer og medarbejder-exit fra arbejdsenheden trods separate associationer mellem disse faktorer på den indirekte/medierende *pathway*. Ganske vist tydede noget evidens på, at associationen mellem organisatoriske ændringer og efterløn blev delvist forklaret ved arbejdsenhedens sociale kapital, ledelseskvalitet og organisatorisk retfærdighed. Bias og confounding blev ikke betragtet som sandsynlige forklaringer på nærværende fund. Politikere og beslutningstager bør øge prioriteringen af strategier til at forebygge skadevirkninger på ansatte af organisatoriske ændringer, idet sådanne negative virkninger ikke blot kan være en byrde for den enkelte, men også for samfundet.

Summary in English

Background: Organizational change at work is common. Such changes are often implemented to meet demands for increased productivity and improved service; however, there seem to be a price to pay among the affected employees. An increasing body of research conclude that organizational changes have a negative impact on the psychosocial work environment, and studies indicate higher rates employee turnover and high risk of adverse health following such changes. Previous research on employee outcomes of organizational changes has mainly focused on major company restructuring or staff downsizings.
This thesis evaluated the impact of specific types of organizational changes in the work unit and subsequent employee turnover (i.e., employee exit from the work unit and non-disability early retirement) and health (i.e., sickness absence, prescription for psychotropic medication, and incident ischemic heart disease). The mediating (explaining) roles of specific psychosocial factors were assessed for associations with employee exit from the work unit and ischemic heart disease. Potential sex and temporal differences were examined in relation to prescriptions for psychotropic medication as outcome.
Methods and Materials: Two work-environment surveys were conducted in the periods from 12 January to 9 February 2011 (*N*=35,560; 81% response) and throughout March 2014 (*N*=37,720; 84% response) among all employees in the Capital Region of Denmark. One self-reported item assessed perceived stress. Measures of social capital, quality of management, and organizational justice aggregated at the work-unit level were based on 16 self-reported items. In 2013 and 2016, the managers provided information on specific types of organizational changes occurring in their work unit between January 2009 through March 2011 (69% response) and in each semester of 2013 (59% response): mergers, demergers/split-ups, relocation, change in management (only in the period 2009-2011), employee layoff, and selective budget cuts. The reference groups comprised employees not exposed to any organizational changes. Data on employee exit from the work unit, total and long-term (≥29 days) sickness absence, prescriptions for psychotropic medication (anxiolytics [ATC code: N05B], hypnotics/sedatives [N05C] or antidepressants [N06A]), and ischemic heart disease (ICD-10: I20-I25) in 2014 as well as information on transition to non-disability early retirement between 2011-2012 were extracted via linkage to national research and regional salary registers. Logistic, zero-inflated Poisson, and hazard/survival regression models as well as multilevel techniques analyzed associations between organization changes in 2013 and employee turnover and health in 2014 (Papers II-III and V-VI), and between organizational

changes in 2009-2011 and non-disability early retirement in 2011-2012 (Paper IV) relative to no changes.

Results: This thesis used data from the WHALE cohort (*Well-being in Hospital Employees*), and a cohort profile was published for reference purposes (Paper I). Some indicators of organizational change, but not all, were associations with 10-50% higher rates of employee turnover relative to no changes (Papers II-IV). Organizational changes were consistently associated with 90-270% higher relative risk of low work-unit social capital. There was an inverse dose-response relationship between lower work-unit social capital and higher employee exit from the work unit. Associations between organizational changes and employee exit from the work unit did not diminish notably when adjusting for work-unit social capital in the regression models (Paper III). Indeed, associations with non-disability did somewhat reduce when adjusting for work-unit social capital, quality of management, and organizational justice simultaneously (Paper IV).

Relative to no change, organizational changes were associated with up to 40% higher risk of sickness absence or prescriptions for psychotropic medication in the following year among employees regardless of sex. Associations with psychotropic prescriptions were strongest for change in management and for prescriptions in the latter semester of the 12-months follow-up period (Papers II and V). Finally, exposure to relocation, change in management, or employee layoff in the work unit was associated with 120-190% higher risk of incident ischemic heart disease among employees relative to no changes. Adjusting these associations for potential mediation via perceived stress did not reduce the point estimates notably (Paper VI).

Conclusions: Organizational changes in the work unit were longitudinally associated with higher rates of subsequent employee turnover and higher risks of adverse among employees relative to no changes. There were no convincing indications that specific types of organizational changes were particularly related to all studied employee outcomes, although changes involving employee layoffs were more consistently associated with higher relative risk of adverse employee health. Work-unit social capital did not explain the inconsistent associations between organizational changes and employee exit from the work unit despite discrete associations between these three factors on the indirect pathway. Indeed, some evidence suggested that the association between organizational changes and non-disability early retirement was partially explained by work-unit social capital, quality of management, and organizational justice. Bias and confounding were not regarded as likely explanations of the current findings. Policy and decision makers should increase prioritization of strategies to

prevent detrimental employee effects of organizational changes as such effects may not only a burden to the individual, but also to society.

Introduction

Organizational change in workplaces is common. Initiatives to changes at work often arise from challenges faced by the organization. Such challenges may include adaption to shifting financial or political climates as well as maximization of cost-efficiency to meet demands for higher productivity and improved service. Managing these challenges is not only an existential premise for private-sector companies, but also for companies in the public sector, including healthcare and social enterprises.[1–4] During the last two decades, all public hospitals in Denmark have been imposed by shifting governments to increase treatment rates by 1.5-2.0% per year without parallel adjustments of budgets.[5] There are, however, no indications that the forces inducing changes at work are diminishing.[6]

Organizational changes have been referred to as a "[…] *difference in form, quality or state over time in an organizational entity*",[7, p. 512] which can take many forms (e.g., mergers, staff downsizing) at different levels in the workplace. Obviously, organizational change does not solely affect the organizational structure, but also the working conditions of the employees. It has been estimated that about half of Danish employees experienced a reorganization that "substantially affected their work" during a three-year period.[8,9] It is thus reasonable to consider organizational change as a characteristic of modern work life.

Modern work life seems also to be characterized by high levels of occupational stress and job insecurity.[9] There is increasing consensus that work-related stress contributes to various physical and mental health problems,[10] including cardiovascular diseases[11,12] and common mental disorders.[13] Worldwide, cardiovascular diseases is the leading cause of death worldwide,[14] while depression and anxiety disorders are among the leading causes of disability.[15] A recent systematic review estimated that work-related stress costs societies up to USD $187 billion globally, where productivity-related losses account for 70-90% of these costs.[16] High rates of sickness absence persist as a workplace problem in many countries,[17,18] including the healthcare sector of Denmark.[19] Poor employee health and well-being may contribute to involuntary exit from paid employment.[20,21] In a hospital context, high rates of employees turnover (i.e., employees leaving the workplace) have been associated with negative effects on the remaining employees, patients, and the healthcare organizations in terms of excessive replacement costs.[22–24] Meanwhile, the old-age dependency ratio is increasing in many countries and there is a need to retain capable employees occupationally active on the labor market to avoid a potential pension crisis.[25] Evidently, work-related stress and excess employee turnover persist as major societal concerns.

Background

Work, stress, and health

There are several theories on determinants for psychological stress. The job demand-control model developed by Robert Karasek in the 1970s has been widely applied in occupational health research. According to this model, it is particularly detrimental for employees to experience the combination of high levels of job demands (e.g., excessive workload, time pressure) and low levels of job control (e.g., poor influence on job tasks, possibilities for learning new skills). It was later emphasized that high social support may mitigate detrimental effects of job strain (i.e., high demand, low control).[26,27]

In the 2000s, another theory emerged and highlighted organizational (in)justice perceived by the employees as a risk factor for psychological stress. According to this conception, adverse health arises if employees experience unfairness regarding distribution of resources (distributive justice), procedures and processes (procedural justice) or distribution of information and respect from managerial authority (interactional justice).[28–30]

Moreover, the concept of social capital highlights the importance of positive social relationships for well-being in a community context. Social capital is defined as the "*resources that are accessed by individuals as a result of their membership of a network or a group*"[31, p. 291] and denotes qualities of social cohesion, mutual trust, and reciprocity among employees (horizontal) and managers (vertical). There has been some disagreement about the appropriate level of analyzing social capital (individual or workplace); however, studying social capital as a feature of working groups (workplace) is concurrent with the notion of this psychosocial factor as a collective ressource.[31,32]

There are many other theories on job stress focusing on e.g. imbalance in relationships between perceived effort and reward,[33] demands and resources[34] etc. Currently, there is neither a golden standard of measuring stress nor consensus about a general comprehensive stress theory comprising the main stressor at work. There seems to be some overlap in contents of current theories on job stress, but no such theory appears explicitly to include the roles of job insecurity or uncertainty at work.

High job insecurity has been linked to detrimental health and turnover intentions among employees in both meta-analyses and reviews.[35,36] Other meta-analyses have shown that high levels of job strain and perceived stress were consistently associated with a 1.1-1.6-fold

higher relative risk of incident ischemic heart disease and stroke in the general population,[37–39] and researchers have argued in favor of a causal impact of stress on cardiovascular diseases.[40] Excess levels of stress may contribute to an advanced burden of atherosclerotic plaque in coronary arteries, and high blood pressure may lead to plaque disruption, which can block or reduce blood flow to the cardiac muscle.[38] A meta-analysis demonstrated that high work stress was associated with a 1.7 times higher relative risk recurrent events of ischemic heart disease.[41]

Reviews and studies have also found excess psychological stress at work to predict depression,[42,43] anxiety,[44,45] and adverse sleep patterns.[46,47] In addition, low organizational justice has been associated with excess turnover intentions[30] and mental health problems independent of job strain, social support, and effort-reward imbalance.[29] Previous research has found low workplace social capital in a hospital setting to predict lower quality of patient care,[48] work engagement,[49] excess emotional exhaustion,[50] hypertension (among males only),[51] and long-term sickness absence (SA) among employees.[52,53] Not surprisingly, a poor psychosocial work environment has been associated with excess turnover rates and intention to quit among employees.[22,54] Still employees may also leave the workplace or the labor market for reasons than ill health.[20,55]

Most research on work, stress, and health are based on self-reported items;[42] however, this methodology may pose various potential problems. One such problem may arise from using the same method (e.g., self-report) to gather data on exposure (e.g., job strain) and outcome (e.g., health status), which is often referred to as common-method bias. Data from same-method sources (e.g., surveys) are likely to share variance from common factors (e.g., social desirability, negative/positive affectivity, context). Likewise, the observed associations are susceptible to be inflated or deflated depending on the correlation of the common factor(s), which may lead to both Type-I (false positive finding) and Type-II errors (false negative finding).[56–58] It has been claimed that common-method variance, in average, accounts for 41% of the total variance in attitude measures compared to 11% when no common-method variance is present. That suggests that common-method bias may play a considerable role in stress research.[56] Common-method bias may indeed have minor impacts in self-reports on occurrence of factual events, such as organizational changes.[58] Indeed, self-reports on organizational change require that the respondent can be contacted following the changes. Finally, self-report may potentially introduce response bias, which refers to the notion that

people interpret and responds to the same questions differently although having equally adverse health or being equally stressed.[59]

Previous research have highlighted the importance of using objective measures of job stress,[42,44] and there seems to be an increasing attention towards employee effects of organizational changes as a putative stressor at the workplace.[60,61] Studying employee effects of organizational change within psychosocial epidemiology may be empirically superior to subjective measures of psychological states since a larger group of employees are typically exposed to the same factual change event simultaneously.

Organizational change at work

Organizational changes at work may potentially have positive as well as negative implications for employees. Positive consequences could include job enlargement, increased influence on work procedures, and improvement of poor working conditions.[62] On the other hand, negative consequences may include higher workload intensification, reduced job control, and higher job insecurity e.g. about future job situation, colleagues or prospects of the workplace.[36,63,64] For example, hospital mergers or downsizing (i.e., staff reduction) may reasonably induce anxiety among employees about being redundant on the workplace following the changes. Further, goals for productivity goals may not be adjusted to (temporary) changes in staff or work flows.

Although restructuring of workplaces is a widely performed strategy to align company operations to changing environments, it has been suggested that hospital mergers have limited long-term impacts regarding productivity, waiting times, and quality of healthcare.[1] A recent systematic review of 39 longitudinal studies concluded that events of reorganization at work mainly had immediate negative effects on the psychosocial work environment, such as lower job satisfaction and trust as well as higher job strain and job insecurity among employees.[61] Employees may not understand managerial decisions for changing the workplace, which could give rise to employee cynicism, perceptions of organizational injustice, lower organizational commitment, and turnover intentions among the employees.[22,65–67]

Employees leave workplaces for voluntary and involuntary reasons. Voluntary exit could be motivated by a poor psychosocial work environment, economic reasons, possibilities for early retirement, and wish to spend more time with significant others. Involuntary exit routes may include dismissal or poor physical or mental health.[20,21,55] A Danish study found that non-

disability early retirement ("*efterløn*") was longitudinally associated with 10 of 16 psychosocial factors, including low levels of organizational justice, predictability, quality of leadership, and trust in management.[68]

A review of cross-sectional and longitudinal evidence from 162 studies on workplace rationalization strategies suggested that downsizing and organizational changes predominantly had negative effects on self-reported health status and well-being (71 negative and 13 positive studies) among employees, particularly within the healthcare sector (36 negative and 2 positive studies).[60] Another review exclusively on longitudinal quantitative evidence found that 11 of 17 studies linked organizational change to higher relative risk of subsequent mental-health problems. The authors concluded that more research using a longitudinal study design is needed to establish this association given the limited number of studies under review.[69]

Table 1 shows an overview of published cross-sectional and longitudinal studies on exposure to organizational change at work presented by outcomes of employee turnover and measures of health among employees. Studies on associations with psychosocial work environment as the only outcome were omitted. The overview is not restricted to the field of public health and epidemiology, but include research studies from other academic disciplines, such as economy, psychology, and sociology.

Table 1. Overview of published studies on associations between organizational changes at work presented by outcomes of employee turnover and health. Each study only appears once.

First author, year	Country	Sample frame	Participation (follow-up)	Type of change	Level of change	Statistical analysis	Outcome ($p<0.05$)
Employee turnover							
Baron, 2001[70]	USA	High-technology start-up firms (n=101)	59%, (≈5 years)	Changes in employment models or blueprints	Company	Multivariate regression, generalized estimating equations (GEE)	Turnover ↑
Bauer, 2004[71]	Germany	Industrial blue- and white-collar workers (n=1,378)	53%, (1 year)	Reduction of hierarchy levels, transfer of responsibilities, and self-managed teams investment in IT	Company	Tobit models	Turnover ↑ (strongest for blue-collar workers)
Cameron, 1987[72]	USA	Higher-education employees (n=3,406)	55%, (cross-sectional)	Organizational decline and turbulence	Colleges/universities	Multivariate analysis of variance (MANOVA)	Turnover intentions ↑
Ingelsrud, 2017[73]	Norway	Hospital employees (n=54,787)	Register based, (4 years)	Mergers	Hospital	Logistic regression, average marginal effects (AME)	Turnover: within hospital sector ↑, to other sectors ↔ out of employment ↔
Probst, 2003[74]	USA	Public service employees (n=313)	63%, (6 months)	Mergers	Company	Analysis of variance (ANOVA)	Turnover intentions ↑, Self-reported health: longitudinal ↓, cross-sectional ↔
Sylling, 2014[75]	USA	Primary care providers (n=11,180)	81%, (≈8 years)	Changes in workflows	Occupational groups	Logistic regression, average marginal effects (AME)	Turnover ↑
Vahtera, 2005[76]	Finland	Municipal employees (n=19,273)	Register based, (5 years)	Downsizing (minor and major)	Occupational group/workplace	Cox proportional hazard models	Disability retirement ↑
Wahlstedt, 1997[62]	Sweden	Postal workers (n=100)	52%, (1 year)	Restructuring	Postal sorting terminal	Multiple regression models	Turnover ↓. Total sickness absence ↓
de Wind, 2014[77]	Netherlands	Senior employees aged 59-63 (n=2,317)	81%, (1 year)	Restructuring (with/without compulsory redundancies)	Self-reported	Logistic regression	Non-disability early retirement ↔.
Sickness absence and health status							
Bernstrøm, 2015[78]	Norway	Health professionals (n=34,712)	Register based, (2 years)	Structural changes and patient care-related changes	Hospital-aggregated	Multilevel logistic regression	Frequent structural changes: Sickness absence (≥17 days) ↑. Frequent patient care-related changes: Sickness absence (≥17 days) ↔

First author, year	Country	Sample frame	Participation (follow-up)	Type of change	Level of change	Statistical analysis	Outcome (p<0.05)
Dragano, 2005[79]	Germany	Population (men, n= 12,240; women, (n=10,319)	61%, (cross-sectional)	Employee's work situation influenced by downsizing	Self-reported	Multivariate logistic regression	Synergistic interaction between downsizing and work-related stress: self-reported health ↓ (comparable for men/women)
Ingelsrud, 2014[80]	Norway	Hospital employees (n=68,630/15,662)	Register based, (2 years)	Merging units, splitting up units, creating new units, shutting down units, reallocation of employees (no differentiation)	Hospital-aggregated	Random/fixed effects Poisson regression models	Sickness absence (≥17 days) ↑
Kivimäki, 2000[81]	Finland	Municipal employees (n=764)	86%, (mean: 4.9 years)	Downsizing (minor and major)	Occupational group/workplace	Multilevel Poisson regression models	Sickness absence (≥4 days) ↑. Mediation: physical demands, skill discretion, possibilities for participation, and job insecurity.
Kivimäki, 2001[82]	Finland	Municipal employees (n=550)	67%, (7 years)	Downsizing	Occupational group/workplace	Logistic regression models	Self-rated health ↓. Mediation: job control, job insecurity, physical demands
Kivimäki, 2003[83]	Finland	Municipal employees (n=886)	76%, (3 years)	Downsizing (minor, intermediate, and major)	Occupational group/workplace	Multiple logistic regression, analysis of variance (ANOVA)	Health problems ↑ (Worse among stayers relative to leavers)
Kjekshus, 2014[84]	Norway	Hospital employees (n=107,209)	Register based, (5 years)	Mergers	Hospital	Fixed-effects multivariate regression models	Sickness absence (≥90 days) ↑
Kokkinen, 2013[85]	Finland	Hospital employees (n=2,794)	Register based, (mean: 9.2 years)	Transfer from public to private sector (no major staff reduction)	Hospital work-units	Cox proportional hazard models	Sickness absence (≥91 days) ↔
Røed, 2007[86]	Norway	Nurses (n=43,167)	Register based, (8 years)	Downsizing and expansion (minor, moderate and major)	Occupational group	Multivariate mixed hazards regression model	Sickness absence (≥17 days) ↑ (only major downsizing)
Theorell, 2003[87]	Sweden	Population (n=4,903)	86%, (4 years)	Expansion and downsizing	Company	Multiple logistic regression	Sickness absence (≥15 days): women ↓, men ↔
Vahtera, 1997[88]	Finland	Local-government employees (n=981)	Register based, (5 years)	Downsizing (minor and major) - reductions in working hours	Occupational group/workplace	Poisson regression models	Sickness absence (≥4 days) ↑
Westerlund, 2004[89]	Sweden	Population (n=24,036)	34%, (6 years)	Expansion, Downsizing, Mergers, Outsourcing	Company	Logistic regression	Expansion: sickness absence (≥90 days) ↑, hospital admission ↑ (large only, whereas moderate ↓). Downsizing: sickness absence ↑ (moderate only). Mergers/Outsourcing: sickness absence, hospital admission ↔.

First author, year	Country	Sample frame	Participation (follow-up)	Type of change	Level of change	Statistical analysis	Outcome ($p<0.05$)
Østhus, 2010[90]	Norway	Hospital employees, (n=1,651,387)	69%, (4 years)	Downsizing (minor and major)	Hospital	Fixed-effects Poisson regression models	Sickness absence (≥4 days) ↑
Mental health							
Blomqvist, 2018[91]	Sweden	Population (n=2,305,795)	Register based, (9 years)	Downsizing (minor and major)	Occupational groups	Logistic regression models, generalized estimating equations (GEE)	Anxiolytics ↑, sedatives ↑ (especially before event among stayers and those who become unemployed) . Sex differences ↔
Brenner, 2014[92]	France, Hungary, Sweden, and UK	Workers excluding farmers, self-employed, workers in micro-businesses, new-jobbers, (n=758)	Sweden: 90%; UK: 82%; France: 62%; Hungary: 19%, (cross-sectional)	Downsizing (medium- and large-scale)	Self-reported (telephone interview)	Multiple logistic regression	Self-reported depressive symptoms ↑ (lay-off survivors, lay-off to unemployment vs lay-off to redeployment)
Dahl, 2011[93]	Denmark	Population (n=92,869)	Register based, (6 years)	Organizational changes targeting six different dimensions	Company	Multivariate analysis with logit models	Psychotropic medication ↑ (multiple simultaneous changes and changes targeting cooperation/coordination)
Falkenberg, 2013[94]	UK	Civil servants (n=6,710)	51%, (8 years)	Major organizational change	Self-reported	Logistic regression	Self-reported psychiatric symptoms: Short-term follow-up, anticipated ↑ happened ↑. Long-term follow-up, anticipated ↑ happened ↔.
Fløvik, 2018[95]	Norway	Public/private sector employees (e.g., municipality, healthcare, finance, insurance, education, non-profit), (n=7,985)	Baseline: 52%, 2nd wave retention: 66% (2 years)	Separate, co-occurring and repeated organizational changes: reorganization, downsizing, layoffs, partial disclosure, partial outsourcing or change of ownership/merger/acquisition	Self-reported	Multilevel logistic regression	Self-reported mental distress as outcome. Separate changes: reorganization ↑, downsizing ↑, layoffs ↑ (individual level). Reorganization ↑ (work-unit level), but ↔ when adjusting for job strain and support. Co-occurring changes: ↑ (individual level). Repeated changes: ↑ (individual level).
Greubel, 2011[96]	Sweden	Police-force employees (n=1,523)	76%, (cross-sectional)	Relocation, extensive downsizing, extensive job changes	Self-reported	Analysis of variance (ANOVA)	Self-reported: Depression ↑ Anxiety ↑ Disturbed sleep ↑
Hanson, 2016[97]	Sweden	Population, (n=1,654,259)	Register based, (4 years)	Major downsizing	Occupational group	Logistic regression models, generalized estimating equations	Antidepressants ↑. Sex differences ↔.

First author, year	Country	Sample frame	Participation (follow-up)	Type of change	Level of change	Statistical analysis	Outcome ($p<0.05$)
						(GEE)	
Kivimäki, 2007[98]	Finland	Municipal employees (n=26,682)	Register based, (7 years)	Downsizing (minor and major)	Occupational group/workplace	Negative binominal regression	Psychotropic medication: women ↑, men ↑
Loretto, 2010[99]	UK	Hospital employees (n=5,385)	Baseline: 18%, 2nd wave retention: 84% (1 year), 3rd wave retention: 77% (2 years)	Organizational changes (related to training/development, work content, peer contact, patient contact)	Self-reported	Logistic regression	Amount of work: Self-reported mental health ↓. Increased training, promotion, job security: self-reported mental health ↑
Moore, 2006[100]	USA	Manufacturing company employees (n=460)	Baseline: 62%, 2nd wave retention: 63%, 3rd wave retention: 74% (6 years)	Direct and indirect layoff contacts (0, 1 or 2)	Self-reported	Multivariate analysis of covariance (MANCOVA)	Job insecurity ↑, self-reported depressive symptoms ↑ (some direct-contact groups), turnover intention ↑
Netterstrøm, 2010[101]	Denmark	Civil servants (n=685)	44%, (2 years)	Mergers	Municipalities/ counties	Logistic regression models	Self-reported depressive symptoms ↔
Väänänen, 2011[102]	Finland	Industrial employees (n=6,511/4,096)	82%, (≈5 years)	Negative merger appraisals	Self-reported	Cox proportional hazard models	Psychiatric events ↑
Cardiovascular outcomes							
Drivas, 2013[103]	Greece	Male ex-employees in public bus company (n=4,400)	Register based, (13 months)	Company closure	Company	-	Death due to ischemic heart disease ↑
Ferrie, 1998[104]	UK	Civil servants (n=7,419)	72%, (≈8 years)	Transfer from public to private sector (actual and anticipated change)	Self-reported	Logistic regression	Men: Self-rated health ↓, adverse sleep patterns ↑, blood pressure ↑ (actual change only), ischemia ↔. Women: Self-rated health ↔, adverse sleep patterns ↔, blood pressure ↔, ischemia ↑ (anticipated change only).
Möller, 2005[105]	Sweden	Population (cases, n= 1,381; referents, n=1,697)	84% (cases) and 73% (referents), (≈2 years)	Appraisal of "change of workplace"	Self-reported	Logistic regression	"*Affected me in a very or fairly negative way*": Incident non-fatal myocardial infarction ↔
Pollard, 2001[106]	UK	Local-government employees (n=184)	65%, (2 years)	Workplace reorganization	County and district councils	Multiple regression models	Blood pressure ↑ Mental distress ↑
Vahtera, 2004[107]	Finland	Municipal employees (n=22,430)	Register based, (7.5 years)	Downsizing (minor and major)	Occupational group/workplace	Cox proportional hazard models, analysis of variance (ANOVA)	Major downsizing: cardiovascular mortality ↑, sickness absence ↑ (only permanent employees)

In line with the direction of findings from systematic reviews,[36,60,61,64,69] the studies outlined in Table 1 suggest that organizational change is predominantly associated with higher rates of employee turnover (or intentions hereof), including non-disability and disability retirement,[70–76,100] as well as higher risk of SA and poor health status,[74,78–84,86,88–90,96,104,107] mental health problems,[91–100,102,106] and cardiovascular outcomes.[87,103,106,107] Only few studies found associations good health status and low turnover rates according to organizational changes.[62,87,99]

Previous studies on the association between organizational changes and SA have predominantly examined employees remaining on the workplace without evaluating the potential accompanying rates of excess employees turnover.[55] Indeed, SA may not solely reflect ill employee health.[108–111] Many previous studies of organizational change and employee health were based on self-reports and there is currently insufficient evidence to conclude on longitudinal associations with clinical measures of adverse physical and mental health among employees.

Differential effects

The literature on employee effects of organizational change has mainly focused on downsizing or major restructuring (e.g., company mergers) without differentiating between specific types of changes involved. When two hospitals merge, it is likely that at least some employees would be relocated or have a new manager. Differentiating between specific types organizational changes may likely require that exposure to organizational changes is assessed at a low level in the hierarchical structure of the workplace to meaningfully separate the changes at the employee level. Organizational changes specified at a low level in the organization may reasonably increase employee exposure classification of true positive (actually experiencing the changes) and true negative (not experiencing the changes) rates. Again, when two hospitals merge (and the exposure variable is aggregated at the hospital level) some employees (e.g., cleaning staff) may not be personally affected by the changes. Indeed, relatively few studies have examined objectively measured changes at the lower work-unit or department level.[62,85,101,106]

One such study[95] assessing various types of organizational changes at the work-unit level found higher relative risk of clinically relevant mental distress according to work-unit reorganization (OR 1.70, 95% CI 1.26-2.30) and partial outsourcing (OR 1.90, 95% CI 1.04-3.44), but not change of ownership/merger/acquisition (OR 0.84, 95% CI 0.40-1.77).

Although these associations were based on self-report data, the findings indicate that organizational change at work is a heterogenous risk factor as difference change types seemed to have different adverse impacts on the employees.

The magnitude and temporal aspects of organization change may also be important to consider in evaluating impacts on employee turnover and health.[95] A study on changes targeting specific dimensions and subsequent prescriptions for psychotropic medications (e.g., benzodiazepines) concluded that excess prescription rates were particularly observed in the immediate years after the changes and among employees experiencing broader changes occurring simultaneously.[93] Other studies found that major, but not minor, downsizing was associated with higher relative risk of long-term SA among nurses in Sweden[86] and higher cardiovascular mortality among permanent municipal employees in Finland.[107] Specifically, in the Finnish 10-town study[107] there was a doubled mortality from cardiovascular diseases during the 7.5-year follow-up period after major downsizing relative to no downsizing. Splitting this follow-up into two halves yielded a 5 times higher cardiovascular mortality in the former half follow-up period, suggesting that cardiovascular outcomes may be observed soon after the changes. Supporting this, Pollard *et al.*[106] found that excess levels of blood pressure peaked among employees just before initiation of substantial workplace reorganizations, which was especially observed among those with most future job uncertainty.

Different health trends have also been observed for employees who leave the workplace and those who remain at work after downsizing. Specifically, better health was found among redeployed employees relative to those remaining at the workplace and employees laid off to unemployment.[83,92] Indeed, studies among the working population in Sweden found higher relative risk of prescription for psychotropic medication among employees without history of substantial SA or disability pension according to major downsizing. Likewise, this association was particularly observed among employees leaving the workplace to unemployment and among those remaining at the workplace after the downsizing event.[91,97] Mental health problems requiring medical treatment may indeed develop over an extended period in contrast to the observation of cardiovascular events.

Some evidence indicate that negative employee effects of organizational change vary by sex,[87,98,112] although this is not consistently demonstrated in the literature.[79,81,91] Potential sex

differences could be due to heterogeneity in social support and psychological demands,[13] but more research is needed need to address potential sex differences in the negative effects of organizational changes.

In statistical analysis, single-level regression model assumes that observations (e.g., employees) are independently distributed;[113] however, this assumption on observation independence may not necessarily hold in studies on organizational change and employee outcomes. Workplaces could be considered a setting where attitudes and norms are "socially contagious" and, thus, employees *within* workplaces may be more similar than employees *between* workplaces.[31] Supporting this, a study demonstrated that depressive symptoms were strongly correlated among members of social groups with associations extending up to three degrees of friendships (i.e., one's friends' friends' friends).[114] Relatively few studies used multilevel techniques (e.g., multilevel modeling, marginal models) to account for potential clustering of employee outcomes within the hierarchical workplace structure, which may increase risk of Type-I error[115,116] as previously demonstrated.[95]

Underlying psychosocial mechanisms

Several factors in the psychosocial work environment have been highlighted as potential mediators (explanations) of adverse employee effects by organizational changes.[36,63,117] Kivimäki *et al.*[81] found that about half of the 2.2-fold higher relative risk of SA was due to increased job insecurity and physical demands as well as lowered job control after major downsizing. Impaired social support from spouse or changes in smoking habits did, however, not seem to mediate the adverse effects.[81] Yet in order to gain a better understanding of the underlying mechanisms of the negative effects of organizational changes, specification of the change types seems imperative since psychosocial factors may relate differently to different change content.[3,118] For example, it is reasonable to assume that job insecurity may be stronger related to staff reductions (e.g., due to fear of new downsizing waves) than relocation or split-ups, whereas workplace mergers may have some lead to pronounced changes in the social community at work (e.g., due to many new colleagues). Indeed, it is likely that several psychosocial pathways may be involved in mediating the negative effects of organizational changes.

Also, organizational changes may induce social disputes among colleagues and management at work. Downsizing has been associated with subsequent distrust and lack of collaboration

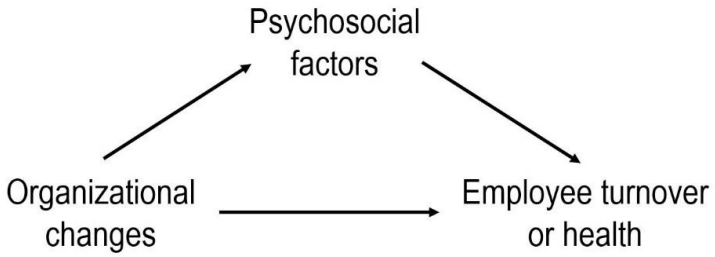
between nurses and medical doctors.[119] Exposure to downsizing, relocation or demergers/split-ups of departments may disrupt social friendship ties among employees, which may induce perceptions of organizational injustice[120,121] that could eventually result in higher voluntary employee turnover from the workplace.[120,122–124] Individual-level social capital has been found to mediate associations between negative work characteristics and mental distress among Japanese workers.[125] Although the literature regarding the relation between organizational change and workplace social capital is sparse, social capital may potentially play an important role in mediating adverse effects of organizational changes together with quality of management and organizational justice. Such mediating properties may warrant these psychosocial factors as targets for interventions to reduce detrimental employee outcomes according to organizational changes. This remains, however, to be investigated.

In sum, organizational change at work seem generally to have immediate negative impacts on employee turnover, stress-related health, and the psychosocial work environment. These negative impacts appear somewhat to vary by sex, types of organizational change, and number of simultaneous changes, although many previous studies have not accounted for potential multilevel clustering of employee outcomes. There is currently insufficient evidence on the dual impact of organizational changes on employee turnover and SA, the impact on non-disability early retirement, and the impact on clinical outcomes of mental health and cardiovascular disease among employees. To gain a better understanding of how the detrimental employee effects of organizational changes develop, there is a need to study the longitudinal associations between specific types of organizational changes at the work-unit level, psychosocial factors, and employee outcomes retrieved from independent data sources using multilevel techniques in statistical analysis.

Objectives and aims

The overall objective was to evaluate the impacts of organizational changes on subsequent employee turnover and health. The mediating properties of factors in the psychosocial work environment were assessed regarding these impacts (Figure 1). A mediator refers to a factor that, at least partially, explains the relation between two other factors.[126] The following unfolds the overall objectives into six specific aims.

Figure 1. The impacts of organizational changes on subsequent employee turnover or adverse employee health mediated through factors in the psychosocial work environment.



The present thesis used data from the *Well-being in Hospital Employees* (WHALE) cohort study. Aim 1 was to provide a detailed description of the WHALE cohort for reference purposes (Paper I). Aims 2-6 assessed the impacts of co-occurring and specific types of work-unit organizational changes (i.e., mergers, demergers/split-ups, relocation, change in management, employee layoff, budget cuts) and:

2. Subsequent employee exit from the work unit (EFW) and sickness absence (Paper II)
3. The role of work-unit social capital (WSC) on the mediating pathway to subsequent employee EFW (Paper III)
4. Non-disability early retirement among senior employees and the potential mediating properties of organizational justice, quality of leadership, and WSC (Paper IV)
5. Temporal aspects of prescriptions for psychotropic medications among employees and the potential modification of effects by sex (Paper V)
6. Incident ischemic heart disease (IHD) among employees and potential mediating properties of perceived stress (Paper VI)

In general, organizational change was hypothesized to have negative impacts on employee turnover and health mediated through the psychosocial factors. Co-occurring changes were expected to have more adverse employee effects than single changes, but no hypotheses were made regarding the relative adverse impacts of each specific type of organizational change.

Methods and Materials

Population and data structure

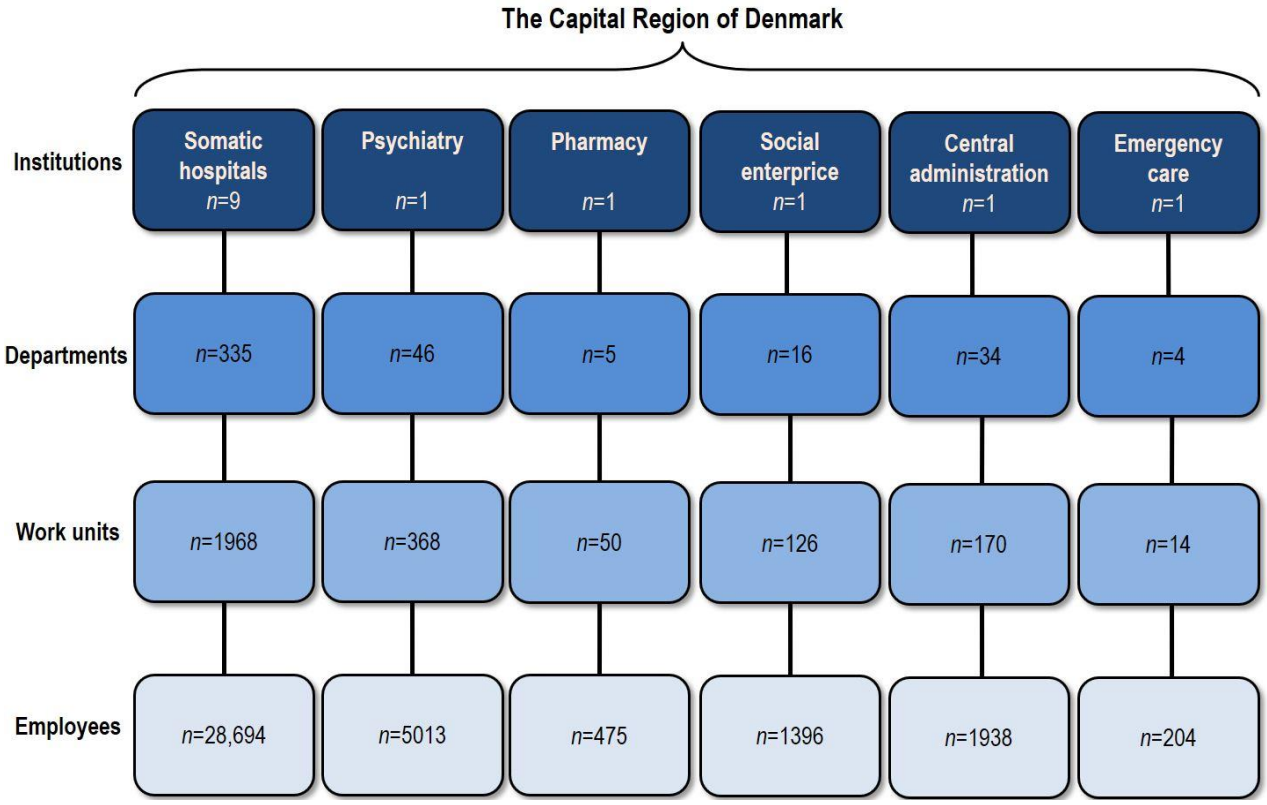
Paper I describes the data and rationale for establishing the observational, ongoing *Well-being in Hospital Employees* (WHALE) cohort. Papers II-III and V-VI examine the longitudinal associations between six types of work-unit organizational changes occurring in the last six months of 2013 (Papers II-III) or throughout 2013 (Papers V-VI), psychosocial factors assessed through March 2014, and subsequent employee exit from the work unit (EFW) and health outcomes from baseline at 1 January 2014 to 31 December 2014. Paper IV examines the longitudinal associations between four types of work-unit organizational changes occurring between January 2009 and March 2011, psychosocial factors measured between January-February 2011, and non-disability early retirement from baseline at 4 April 2011 to 31 December 2012.

The source population included all employees in the Capital Region of Denmark, who were invited to participate in a work-environment survey ("*TrivselOP*") conducted from 12 January through 9 February 2011 (*N*=35,560; 81% response) and, again, throughout March 2014 (*N*=37,720; 84% response). The populations for these two surveys were established 5 November 2010 and 13 January 2014. The vast majority of the questionnaires were distributed through working emails, while paper versions of the questionnaires were administered to employees without a working email-address (e.g., cleaning staff). Up to three reminders on completing the questionnaire were sent to employees in each wave. In the 2011-survey, 46 items concerned the psychosocial work environment, whereas this number was reduced to 40 in the 2014-survey (37 psychosocial items were overlapping in the two surveys). The data from the surveys included items responses as well as cross-sectional occupational background information and organizational affiliations (<1% missing data). Men and medical doctors/dentists were somewhat underrepresented among respondents. The two work-environment surveys were not conducted for research purposes to begin with.

In 2014, all 37,720 employees were nested within 2,686 work units (e.g., Research Unit), which were nested within 440 departments (e.g., Department of Occupational and Environmental Medicine) nested within 14 institutions (e.g., Bispebjerg & Frederiksberg

Hospitals) (Figure 2). The work-unit structure was validated by the work-unit managers prior to each survey.

Figure 2. All 37,720 healthcare employees nested within the hierarchical organizational structure of the Capital Region of Denmark by January 2014. In total, 1,105 employees were not assigned to the department level.



Data on organizational changes occurring before to the work-environment surveys were obtained by distributing a two-wave Internet survey via working email to the managers of all work units. The first wave was conducted from October to November 2013 (69% response) providing information on organizational changes occurring between 1 January 2009 and 31 March 2011 (entire period). The second wave was conducted from April to June 2016 (59% response) providing information on occurrence of organizational changes in the semesters between 1 January 2011 and 31 December 2013. In both waves, the managers responded to occurrence of the following specific types of organizational changes in their work unit:

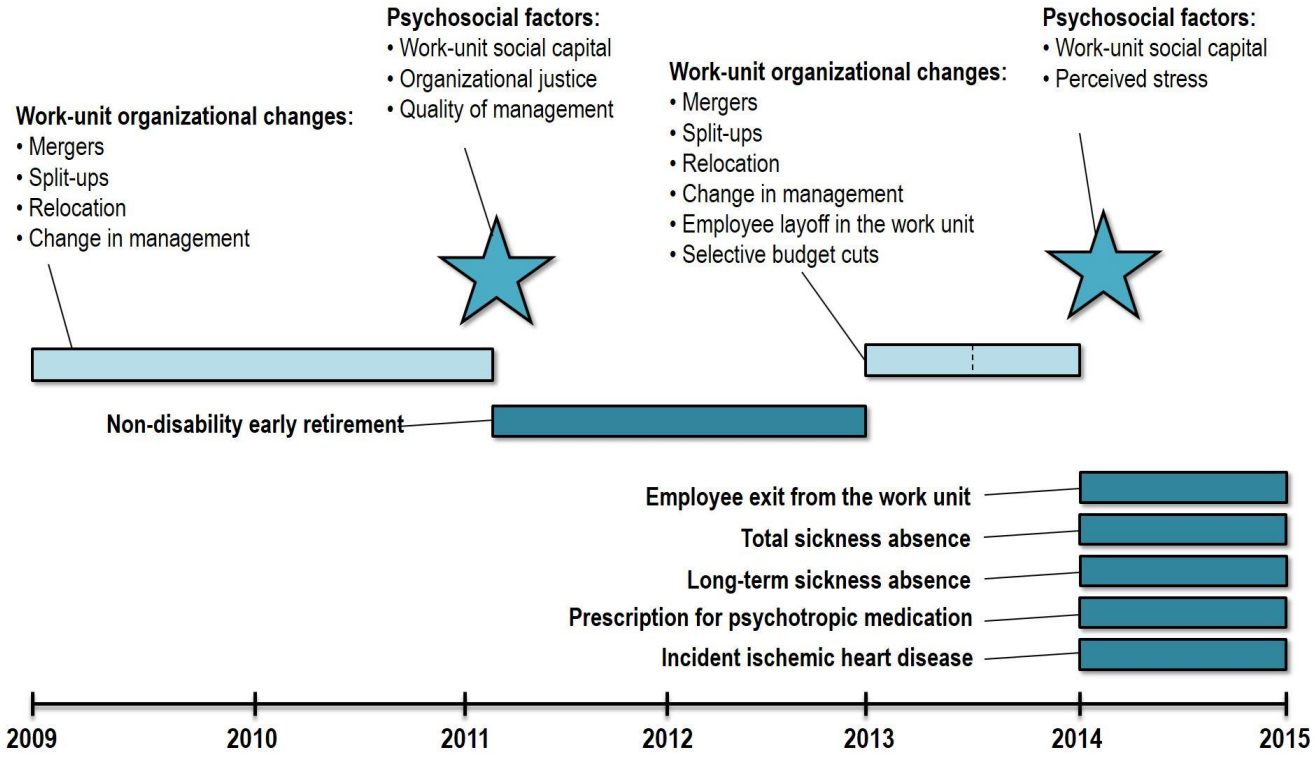
In the work unit you manage/managed, have there been the following organizational changes in the period from 1 January 2009 to 31 March 2011 [or] *1 January 2011 to 31 December 2013* [each semester]*?":*

- Merger with other work unit(s)
- Split up into other work units
- Change of management in work unit
- Physical relocation of the work unit
- Employee layoff(s)*
- Selective budget cuts*

** Items only provided in the second-wave survey regarding organizational changes occurring between 2011-2013.*

Monthly outcome information on employee EFW and sickness absence (SA) in 2014 (Papers II-III) as well as monthly occupational/sociodemographic information were extracted from regional salary registers at the employee level via personal and employee identification numbers. Daily outcome information on non-disability early retirement between 2011-2012 (Paper IV) and prescriptions for psychotropic medication (Paper V) and incident events of ischemic heart disease (IHD) in 2014 (Paper VI) were extracted from national registers at the employee level via personal identification numbers. Figure 3 presents a temporal overview of the applied data on organizational changes, psychosocial factors, and employee outcomes.

Figure 3. Graphical overview of applied data on work-unit organizational changes, psychosocial work environment, employee turnover, and health outcomes.



Inclusion criteria

In this thesis, a work unit was defined as an organizational entity of at least three employees referring to the same immediate manager. Monthly data on occupational information extracted from regional salary registers allowed Papers II-III and V-VI to include employees older than 18 of age who worked more than 18.5 hours per week in the same unit through one year prior to baseline. Employees from a given work unit were considered eligible for study participation if at least three of employees and more than 30% of the personnel remained in the same work unit throughout 2013. For instance, if two work units, each comprising three employees, merged, all six employees were eligible for study participation. These inclusion criteria aimed to increase true positive and true negative classifications of exposure to organizational changes and exclude employees with a short-term work-unit affiliation. The monthly occupational data from the regional salary registers were, however, not available during the study of Paper IV.

In Papers II-III and V-VI, the study population comprised at least 15,038 employees (58% of the eligible population) nested within 1,284 work units across 13 institutions with complete data on all relevant variables at baseline 1 January 2014. Among the employees in the study population, 55% were exposed to any organizational changes throughout 2013. Employee characteristics were comparable between the eligible population, study population, and among employees exposed to organizational changes, but work units exposed to organizational change seemed to include a slightly higher number of employees at baseline. Rates of employee outcomes and WSC levels in 2014 were also comparable between the eligible and the study population, although the employee-turnover rates were somewhat lower in the study population (Table 2).

In Paper IV, 3,254 senior employees aged 58-64 at baseline 4 April 2011 were eligible for non-disability early retirement for at least one week between from baseline to 31 December 2012. Of these senior employees, 642 (19.7%) transferred to the non-disability early retirement scheme during follow-up between 2011 and 2012.

Table 2. Characteristics and outcomes through 2014 among employees nested within work units nested within institutions presented for the eligible population, the study population, and among employees exposed to any organizational changes.

	Categorical variables	Eligible population		Study population		Exposed to any changes	
		n	**% of *N***	***n***	**% of *N***	***n***	**% of *N***
Employee-level, *N*		25,897	100	15,038	100	8,242	100
Employee outcomes through 2014							
Employee exit from the work unit		4,720	18.2	2,610	17.4	1,485	18.0
Non-disability early retirement*		306	1.2	172	1.1	98	1.2
Total SA percentage, *mean* (SD)		5 (8.6)	-	5 (8.4)	-	5 (8.8)	-
Long-term SA events		1,524	5.9	881	6.0	516	6.4
Prescription for psychotropic medication		2,776	10.7	1,616	10.7	931	11.3
Ischemic heart disease (prevalence)		91	0.4	59	0.4	35	0.4
Age, *mean* (SD)		47 (10.7)	-	47 (10.6)	-	47 (10.7)	-
Sex	Females	19,808	76.5	11,507	76.5	6,299	76.4
	Males	6,089	23.5	3,531	23.5	1,943	23.6
Occupational group	Nurses	11,174	43.1	6,534	43.4	3,682	44.7
	Medical doctors/dentists	2,791	10.8	1,464	9.7	758	9.2
	Social/healthcare workers	3,242	12.5	1,966	13.1	1,055	12.8
	Pedagogical workers	761	2.9	401	2.7	217	2.6
	Service/technical workers	3,091	11.9	1,864	12.4	975	11.8
	Administration workers	4,838	18.7	2,809	18.7	1,555	18.9
Part-time employment	No	16,676	64.4	9,613	63.9	5,238	63.6
	Yes	9,221	35.6	5,425	36.1	3,004	36.4
Manager status	No	24,053	92.9	14,040	93.4	7,591	92.1
	Yes	1,843	7.1	998	6.6	651	7.9
Contractual employment	No	1,965	7.6	1,066	7.1	487	5.9
	Yes	23,932	92.4	13,972	92.9	7,755	94.1
Prior sickness absence, days	0	7,209	27.8	4,132	27.5	2,274	27.6
	1-3	5,582	21.6	3,242	21.6	1,760	21.4
	4-6	3,928	15.2	2,292	15.2	1,271	15.4
	7-13	4,927	19.0	2,877	19.1	1,517	18.4
	14≤	4,251	16.4	2,495	16.6	1,420	17.2
Seniority years, *mean* (SD)		13 (10.3)	-	13 (10.3)	-	13 (10.3)	-
Personal gross income (€)**, *mean* (SD)		59,923 (32,239.3)	-	59,066 (29,182.7)	-	59,066 (29,819.1)	-
Work-unit level, *N*		2,318	100.0	1,284	100.0	642	100.0
No. of employees within work units, *mean* (SD)		16 (12.9)	-	16 (13.3)	-	18 (14.3)	-
WSC, low-high (0-100), *mean* (SD)		68 (9.8)	-	69 (9.8)	-	68 (9.8)	-
Institution level, *N*		13	100.0	13	100.0	13	100.0

The source population included 37,720 employees, 2,696 work units, and 14 institutions.

Abbreviations: SA=Sickness absence, SD=Standard deviation, WSC=Work-unit social capital.

** Paper IV examined weekly employee transition to non-disability early retirement from 4 April 2011 to 31 December 2012. ** 1 euro (€) = 7.5 Danish kroner (DKK).*

Measures

Organizational changes in the work unit

Several indicator variables of organizational changes occurring in the work unit prior to the work-environment surveys were created: one indicator variable for exposure to any changes (Papers II-III and V-VI), one indicator variable for the number of organizational changes occurring simultaneously (1, 2 or 3≤ types of changes; Papers II-III and V), and six indicator variables for each of the specific types of organizational changes (mergers, demergers/split-ups, relocation, change in management, employee layoff, and budget cuts). The reference category for all change-indicator variables was non-exposure to any organizational changes. Papers II-III examined organizational changes occurring only in the last six months of 2013, whereas Papers V-VI used data on organizational changes occurring throughout 2013. Paper IV included four change-indicator variables for mergers, demergers/split-ups, relocation or change in management relative to no changes occurring in the period January 2009 to March 2011.

Throughout 2013, 55% of the employees in the study population experienced any organizational changes: 29% experienced one type of change, 15% experienced two types of changes, and 11% experienced at least three types of changes. Change in management, employee layoff in the work unit, and mergers were the types of changes experienced most frequently. None of the specific types of organizational changes were completely overlapping since co-occurrence rates were 56% or below (Table 3).

Table 3. Distribution of co-occurring types of organizational changes throughout 2013 as experienced by the employees in the study population (N=15,038).

	Employees, *n* (% of *N*)	Mergers, %	Demergers/ split-ups, %	Relocation, %	Change in management, %	Employee layoff, %	Budget cuts, %
Any changes	8,242 (55)	31	12	22	46	39	29
Mergers	2,560 (17)		20	41	53	28	25
Demerger/split-ups	956 (6)	54		46	55	31	21
Relocation	1,872 (12)	56	23		46	27	17
Change in management	3,781 (25)	36	14	23		28	22
Employee layoff	3,204 (21)	22	9	16	33		45
Budget cuts	2,401 (16)	27	8	13	35	45	

Employee exit from the work unit and sickness absence

In Papers II-III, information on employee EFW and SA were calculated based on monthly data from salary registers in the Capital Region of Denmark. Employee EFW was defined as the month where an employee was no longer affiliated with the work unit at baseline regardless of the reason. Since some work units were assumed to undergo changes during follow-up, employees were not classified as EFW if a significant proportion of the staff (i.e., at least 30% and three employees) continued to work in the changed work unit.

Regarding SA, both events (yes/no) and percentages of total SA and long-term SA were examined. Long-term SA was defined as at least one spell of ≥29 days of SA in keeping with Danish regulations of public sickness benefits.[127] The rationale for analyzing both total and long-term SA was that total SA comprises all types of SA (e.g., due to short-term SA, sporadic diseases, non-illness reasons), whereas long-term SA likely reflects long standing illness.[110,128,129] The rationale for examining events and percentages of SA was to assess if organizational changes were both associated with more employees displaying SA behavior and the magnitude of SA behavior.

Many previous studies used the number of spells as measure of SA.[60,61] However, in the present study such approach would reasonably inflate the amount of SA observed since registry of SA in the Capital Region of Denmark was based on both calling in *sick* and calling in *back* to work following sickness. For example, if an employee was sick-listed from work Thursday through Friday and the employee returns to work as scheduled on the following Tuesday (i.e., free from work Saturday-Monday), the observed spells of SA would be 5 (Thursday-Monday) although the employee was absent for 2 only working days (Thursday-Friday). Particularly, such scenario poses a potential bias in a healthcare context because many hospital employees work on shifting schedules and irregular working hours. The bias was assumed to inflate the observed short-term SA mostly.

To reduce this potential bias of inflated SA, the percentage of SA during follow-up was calculated relative to the missed fixed working hours due to total SA and long-term SA until EFW. For instance, if an employee worked in the same work unit from 1 January 2014 until EFW at 16 February 2014, the percentage of SA was calculated relative to the fixed working hours for that period. This approach was chosen since organizational changes and their accompanying processes may unfold over an extended period and the impacts of moving from a non-exposed to an exposed work unit during follow-up were unclear.

Non-disability early retirement

Paper IV used data on transition to non-disability early retirement ("*efterløn*") among eligible senior employees. Individual-level data on early retirement were obtained via linkage to the national DREAM ("*Den Registerbaserede Evaluering Af Marginalsamfundet*") database, which holds weekly information on all public transfer payments in Denmark.[130]

The Danish early retirement scheme is a public welfare benefit allowing eligible employees aged 60-64 to withdraw voluntarily from the labor market before the nominal retirement age of 65. The benefit is smaller than the salary previously earned, but the fixed payment rates increases with age. Eligibility to the early retirement includes membership to an unemployment-insurance company for a given period prior to early retirement as well as capability of having a full-time job (i.e., 37 weekly working hours) at age 60.

Prescriptions for psychotropic medication

Paper V used information on prescription for psychotropic medication, including anxiolytics (World Health Organization's [WHO] Anatomical Therapeutic Chemical [ATC] classification system codes: N05B), hypnotics and sedatives (ATC: N05C), and antidepressants (ATC: N06A). These classes of psychotropic medications are used worldwide to treat common mental health disorders, such as anxiety and depression, and to normalize circadian rhythm. In Denmark, legal purchase of all psychotropic medications requires a prescription issued by a physician.

Individual-level data on prescriptions for psychotropic medication were extracted from the National Prescription Registry, which holds daily information on all medications given at hospitals or purchased in shops or pharmacies in Denmark. The data on psychotropic prescriptions were applied regardless of the intended duration or dosage.[131]

Ischemic heart disease

Paper VI investigated the associations with IHD (International Classification of Diseases, 10th revision, [ICD-10] codes: I20-I25). Individual-level data on IHD were obtained via linkage to the National Patient Register and the Cause of Death Register. The National Patient Register holds daily information on patient encounters with all public and private hospitals in Denmark. These data include date of hospital admission and diagnoses according to ICD-10.[132] The Cause of Death Register holds daily information on all causes of death based on death certificates issued by a physician.[133] However, according to the death register, no

employees from the study population in Paper VI died due to IHD during the follow-up period in 2014.

Psychosocial work environment

Papers III-IV and VI evaluated the mediating roles of factors in the psychosocial work environment on the pathway from organizational changes to employee turnover or health. These psychosocial factors included perceived stress measured at the employee level as well as aggregated measures of social capital, organizational justice, and quality of leadership at the work-unit level. The psychosocial factors were based on a total of 16 unique self-reported items from the work-environment surveys using a 5 or 7 point-Likert scale. In total, 12 psychosocial items originated from the Copenhagen Psychosocial Questionnaire, 2nd version (COPSOQ-II),[134] whereas the remaining 4 items were developed by human resource, the management, and employee representatives (Table 4). Specialists in occupational medicine selected the items comprising the composite psychosocial scales measuring social capital, quality of management, and organizational justice, since these psychosocial factors were not assessed with established questionnaires.

Table 4. Items from work-environment surveys in January-February 2011 and March 2014 used to measure the factors in the psychosocial work environment.

Psychosocial factor	Item (5 or 7 point-Likert scale)
	"To what degree…
Perceived stress	*...have you been stressed for the last six months?"* (5)*
Social capital	*...are you and your colleagues good at coming up with suggestions for improving work procedures?" (5)*
	...do you get help and support from your colleagues when needed?" (5)*
	...do you and your colleagues take responsibility for a nice atmosphere and tone of communication?" (5)
	...does the management trust the employees to do their work well?" (7)*
	...can you trust the information that comes from the management?" (7)*
	...are conflicts resolved in a fair way?" (7)*
	...is the work distributed fairly?" (7)*
	...is your staff group respected by the other staff groups at the workplace?"
Quality of management	*…does the management enough to help employees cope with emotionally demanding situations at work?" (5)*
	…do your immediate superior gives high priority to job satisfaction?" (5)*
	…do your immediate superior is good at work planning?" (5)*
	…do you get help and support from your immediate superior when needed?" (5)*
Organizational justice	*…do you are informed well in advance concerning for example important decisions, changes, or plans for the future?"* (5)*
	…do you receive all information you need in order to do your job well?" (5)*
	…can you trust information coming from the management?" (7)*
	…does the management trusts employees to do their job well?" (7)*
	…are conflicts resolved in a fair way?" (7)*
	…is the work distributed fairly?" (7)*

** Item originated from the Copenhagen Psychosocial Questionnaire, 2nd version (COPSOQ-II).*[134]

5-point response scale: 1: "Not at all"; 2: "To a lesser degree"; 3: "To some degree"; 4: "To a high degree"; 5: "To a very high degree".
7-point response scale: 1: "Not at all"; 2; 3; 4; 5; 6; 7: "To a very high degree".
Items and responses translated from Danish.

All item responses were recoded to a scale ranging 0-100 (low-high). To establish the composite scales, employee-level scores were computed as the mean value of each scale for employees responding to at least half of the items. Next, work-unit level scores were computed by aggregating the employee-level scores in work units with ≤50% missingness. Finally, the WSC scores were assigned to all employees within each work unit, including employees not responding to the psychosocial questionnaire. In Paper III, the WSC variable was categorized into quartiles.
There has been some disagreement about the appropriate level of analyzing social capital (e.g., employee, work-unit, department or company level).[32,52,53] The current thesis analyzed WSC in keeping with the conceptualization of social capital as an organizational characteristic and organizational changes being measured at the work-unit level.

All the composite psychosocial scales showed good internal consistency as Cronbach's alpha values ranged 0.8-0.9.[135] Principal factor analyses with no rotation showed single-factor loadings for the psychosocial scales of social capital (Factor 1: 3.46, Factor 2: 0.78, Measure of Sampling Adequacy [MSA]: 0.86), quality of management (Factor 1: 1.42, MSA: 0.60), and organizational justice (Factor 1: 2.60, MSA: 0.80) as indicated by Eigenvalues above 1 (Kaiser's criterion) and acceptable MSA values.[136] Promax oblique rotation yielded a two-factor solution for the social-capital scale (Factor 1: 1.89, Factor 2: 1.06) loading on justice/trust-related items and collaboration-related items, while rotation was not possible for the scales on quality of management and organizational justice. These alpha and factor analyses indicate the reliability and the validity of the composite psychosocial scales.

Potential covariates

Different strategies for confounder adjustments were applied in keeping with the aim of each paper. The following employee-level variables were used as potential confounders in regression models for associations with employee turnover or health: age, sex, occupational group, personal gross income, prior SA, child-related absence, civil status, household gross income, prior hospitalization for medical diagnosis, seniority, contractual employment,

working hours, and manager status. The following variables at the work-unit level were also used as potential confounders: number of employees within work unit and other types of organizational changes.

In Paper III, the following work-unit-level variables were applied as potential confounders for the association between organizational changes and WSC (as exposure and outcome were both measured at the work-unit level): work-unit means of employee age, personal gross income, and prior SA as well as work-unit proportions of females, employees with child-related absence, nurses, administrative staff, social/healthcare/pedagogical workers, service/technical staff, and medical doctors/dentists.
Data on all potential covariates were extracted from regional registers except income, civil status, and prior hospitalization, which were extracted from national registers.

Study designs and timing

Traditionally, the randomized controlled trial has been considered the golden standard of study designs for evaluating intervention effects in medical research, since selection bias and confounding are minimized. It is, however, not always ethically possible to randomly allocate the exposure/non-exposure to the participants, and observational research studies with time ordering of exposure and follow-up on outcome may serve as the next best level of evidence.[137,138]

Papers II-III and V-VI examined the effects of organizational changes occurring in the last six months of 2013 and throughout 2013, respectively, on employee turnover and health outcomes in 2014. Exposure observation was extended to an entire year in Papers V-VI to increase statistical power. Although more data covering a larger period were available, these relatively short exposure and follow-up periods were chosen due to following reasons. First, exposure to organizational changes was limited to occurrence in 2013 to reduce potential employee EFW for change-related reasons before baseline in 2014, and, second, to assess psychosocial factors as potential mediators immediately after the changes (March 2014). Third, baseline was defined following the organizational changes to distinguish the timing in occurrence of exposure before outcome. Fourth, follow-up on employee EFW and health outcomes were restricted to one year only (2014) to reduce impacts of behaviors related to

new changes (e.g., rumors, announcements, actual changes) during follow-up on employee outcomes.

Paper IV examined associations between organizational changes and non-disability early retirement during a four-year study period; however, since non-disability early retirement is not granted on health grounds and benefit payments increases with later transition, retirement effects may occur over an extended period.

Main statistical analyses

In Paper II, Cox proportional hazards regression models estimated hazard ratios (HR) and 95% confidence intervals (CI) for months to subsequent employee EFW after organizational changes relative to no changes. To account for the excess proportion of employees with no SA observed during follow-up, zero-inflated Poisson (ZIP) regression models analyzed associations with total and long-term SA according to organizational changes.[139] The ZIP models estimated odds ratios (OR) and 95% CIs for the events of any (total) SA and long-term SA as well as rate ratios (RR) and 95% CIs for the percentages of missed fixed working hours due total SA and long-term SA among the sick employees (i.e., four SA outcomes in total).

In Paper III, logistic regression models weighted by the number of employees within each work unit assessed the ORs and 95% CIs for lower levels of WSC (than high WSC) following organizational changes relative to no changes. Cox models with average marginal effects accounting for clustering[140] at the work-unit level analyzed the HRs and 95% CIs for months to employee EFW according to levels of WSC. Marginal Cox models were also applied to evaluate the mediating properties of WSC on the association between organizational changes and subsequent employee EFW as indicated by a drop in the HR point estimate for the outcome (EFW) when adjusting the potential mediator (WSC) in the regression model.[126]

In Paper IV, Cox models estimated HRs and 95% CIs for non-disability early retirement according to organizational changes and WSC among senior employees. Again, the mediating role of WSC, organizational justice, and quality of management between changes and early retirement were evaluated by comparing point estimates from Cox models with and without adjustment for these psychosocial factors.[126]

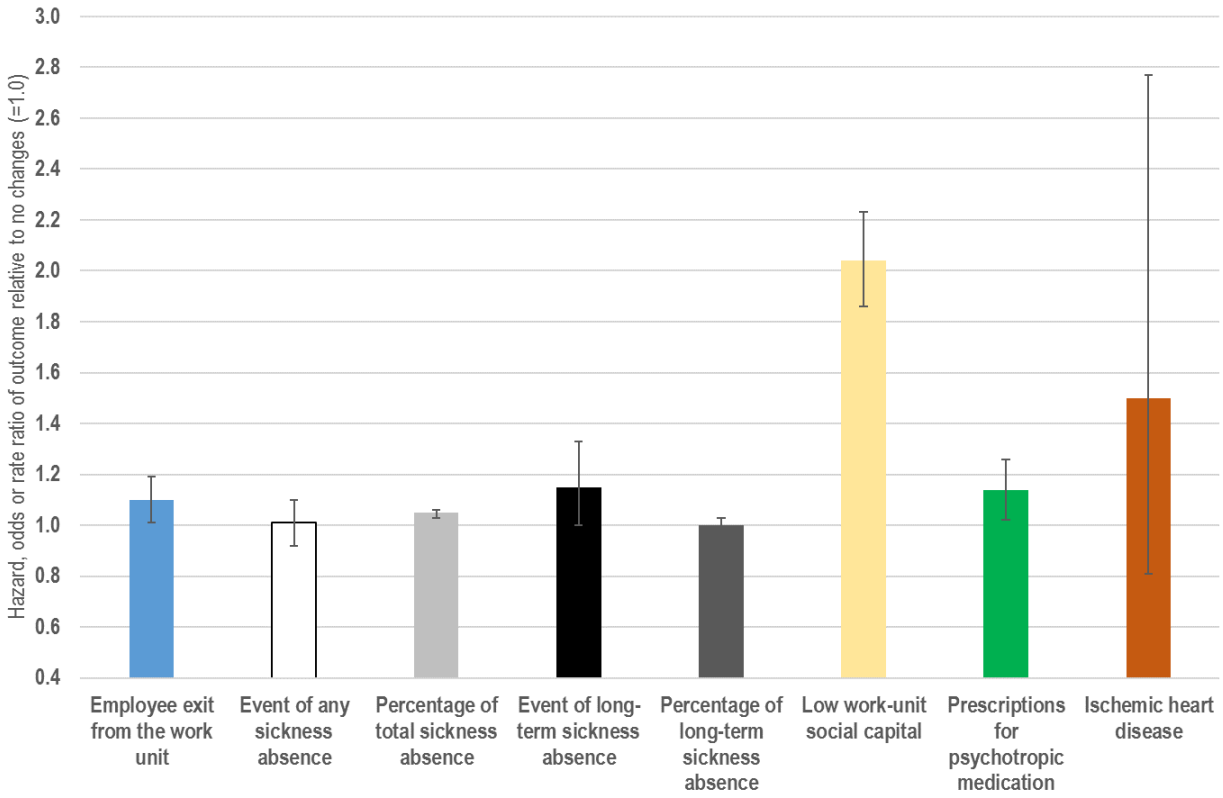
In Papers V-VI, multilevel mixed-effects survival models analyzed the HRs and 95% CIs for psychotropic prescriptions and incident IHD after organizational changes compared to no changes.[141] Associations with IHD accounted for clustering at the work-unit and the institution level, whereas associations with psychotropic prescriptions only accounted for clustering at the work-unit level for convergence reasons. Intraclass correlation coefficients evaluated the partitioning of these higher levels in the variance of each health outcome.[142] In addition, Paper V analyzed potential sex differences in psychotropic prescriptions with additive and multiplicative interaction models, while Paper VI evaluated the mediating properties of perceived stress on the association between organizational changes and IHD using the aforementioned approach.[126]

An alpha-level of statistical significance was set to 0.05. All statistical analyses were conducted using SAS version 9.4 software (SAS Institute Inc., Cary, North Carolina, USA) or STATA version 14.2 software (Stata Corporation, College Station, Texas, USA).

Main results

Exposure to any type of organizational changes was statistically significantly associated with excess rate ratios of subsequent employee exit from the work unit (HR 1.10, 95% CI 1.01-1.19) and total sickness absence (SA) percentage (RR 1.05, 95% CI 1.03-1.06) compared to no changes. Exposure to any changes was also associated with higher relative risk of long-term SA event (OR 1.15, 95% CI 1.00-1.33), low work-unit social capital (WSC) (vs. high: OR 2.04, 95% CI 1.86-2.23), and prescriptions for psychotropic medication (HR 1.14, 95% CI 1.02-1.26) among the employee remaining in the work unit after the changes. The direction of these findings was also observed for associations with incident ischemic heart disease (IHD) (HR 1.50, 95% CI 0.81-2.77) (Figure 4) and non-disability early retirement (results presented in the section below).

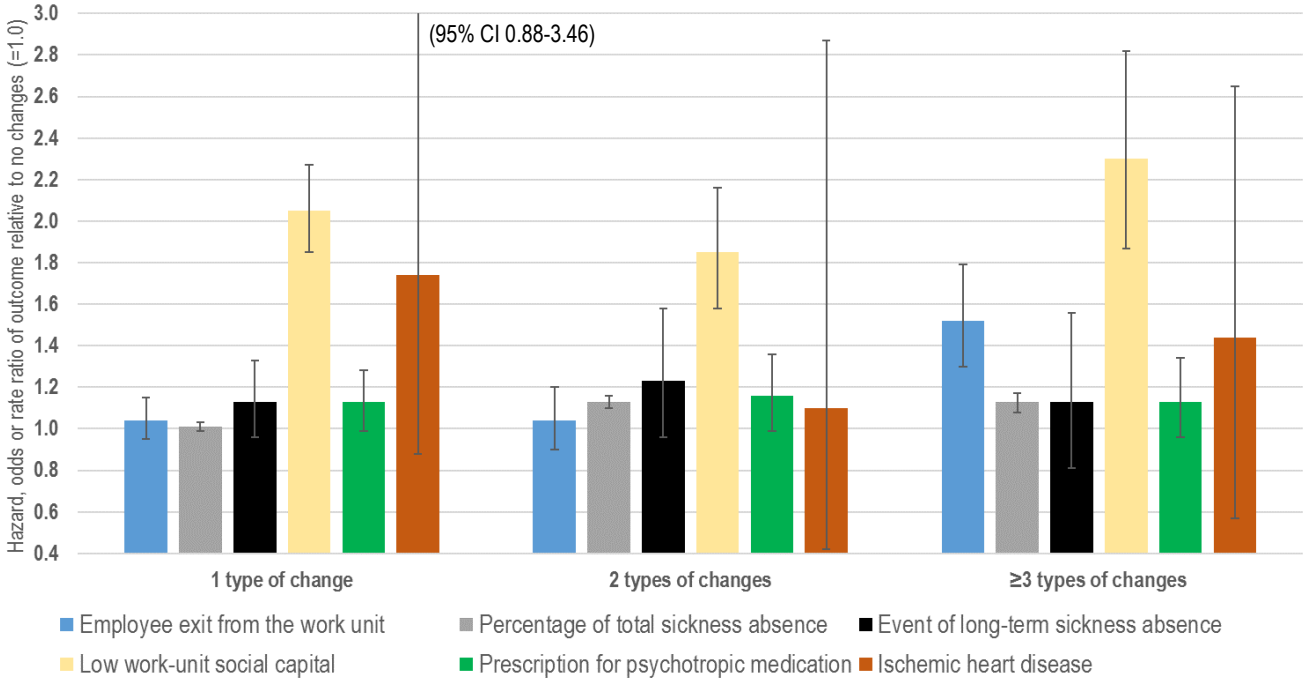
Figure 4. Adjusted rate ratio of employee exit from the work unit and relative risks of adverse health outcome among employees or low work-unit social capital with 95% confidence intervals associated with any organizational changes relative to no changes (references: 1.0).



The presented estimates are not comparable between outcomes since exposure and reference groups differ.

Exposure to a greater number of organizational changes occurring simultaneously was not consistently associated with more adverse employee health or WSC outcomes, but the rate of employee EFW after ≥3 simultaneous changes were considerably high relative to no changes (HR 1.52, 95% CI 1.30-1.79) (Figure 5).

Figure 5. Adjusted rate ratio of employee exit from the work unit and relative risks of adverse health among employees or low work-unit social capital with 95% confidence intervals (CI) associated with higher number of organizational changes occurring simultaneously relative to no changes (references: 1.0).



The presented estimates are not comparable between outcomes since exposure and reference groups differ.

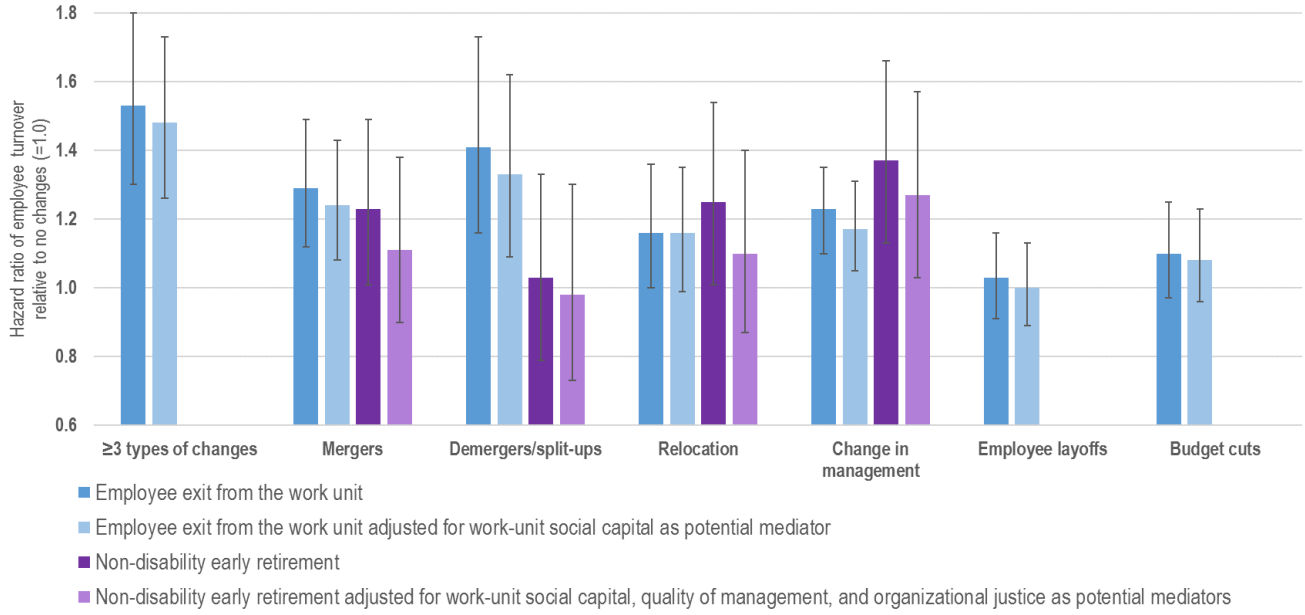
Employee turnover, sickness absence, and work-unit social capital

Regarding exposure to specific types of organizational changes, higher rates of subsequent employee EFW were found after mergers (HR 1.29, 95% CI 1.12-1.49), demergers/split-ups (HR 1.41, 95% CI 1.16-1.71), relocation (HR 1.16, 95% CI 1.00-1.35), and change in management (HR 1.24, 95% CI 1.11-1.38) relative to no change. These associations were also observed for non-disability early retirement among senior employees following mergers (HR 1.23, 95% CI 1.01-1.49), relocation (HR 1.25, 95% CI 1.01-1.54), change in management (HR 1.37, 95% CI 1.13-1.66). Exposure to employee layoffs or budget cuts in the work unit were not associated with subsequent employee EFW, while exposure to demergers/split-ups

was not associated with non-disability early retirement. There were indeed no data on work-unit employee layoffs or budget cuts to analyze associations with employee early retirement in Paper IV.

All change indicators were statistically significantly associated with low WSC relative to high WSC as reference, except relocation (OR 1.13, 95% CI 0.96-1.33). Moreover, lower WSC was associated with higher rate ratios of employee EFW in a dose-response manner (low vs. high WSC: HR 1.65, 95% CI 1.46-1.86). There were, however, no convincing indications of WSC mediating the rather inconsistent longitudinal associations between organizational changes and subsequent employee EFW. Yet, adjusting for WSC, quality of management, and organizational justice in the regression models for early retirement somewhat reduced HR point estimates for mergers (HR 1.23 vs. 1.11), relocation (HR 1.25 vs. 1.10), and change in management (HR 1.37 vs. 1.27). This suggests that the association between specific types of organizational change and non-disability early retirement is, at least partially, mediated through these three psychosocial factors (Figure 6).

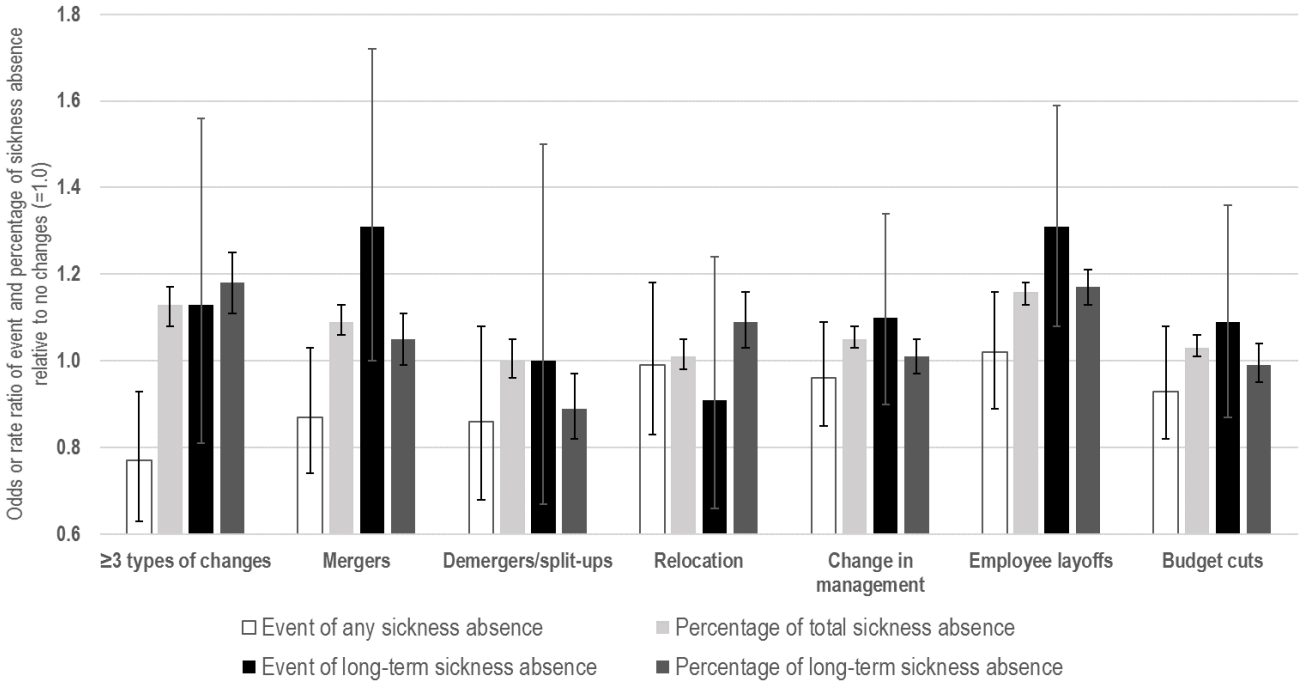
Figure 6. Adjusted hazard ratios of employee exit from the work unit or non-disability early retirement with 95% confidence intervals following specific types of organizational changes relative to no changes (references: 1.0).



The presented estimates are not comparable between outcomes since exposure and reference groups differ.

Relative to no change, exposure to ≥3 types of organizational changes occurring simultaneously was associated with a *lower* risk of subsequent events of any (total) SA (OR 0.77, 95% CI 0.63-0.93) in the study population, but a higher rate of total SA percentage (RR 1.13, 95% CI 1.08-1.17) among sick-listed employees only. Other change indicators were also associated with higher SA percentages among those sick-listed. Specifically, mergers and employee layoffs were both statistically significantly associated with excess total SA percentages (RR 1.09, 95% CI 1.06-1.13 and RR 1.16, 95% CI 1.13-1.18, respectively) as well as a higher relative risk of long-term SA events (OR 1.31, 95% CI 1.00-1.72 and OR 1.31, 95% CI 1.08-1.59, respectively) (Figure 7).

Figure 7. Adjusted risk of sickness-absence event and rate sickness-absence percentage and 95% confidence intervals in the year following specific types of organizational changes occurring in the last six months of 2013 relative to no changes (references: 1.0).



Prescriptions for psychotropic medication and ischemic heart disease

Only change of management was associated with a higher relative risk of prescription for psychotropic medications throughout the following year (HR 1.23, 95% CI 1.07-1.41), whereas the remaining specific types of organizational change were not statistically

significantly associated with psychotropic prescriptions. Dividing follow-up period into two halves showed associations with higher relative risk of psychotropic prescriptions during the latter 6 months of the 12-months follow-up period after mergers (HR 1.26, 95% CI 1.06-1.50), change in management (HR 1.42, 95% CI 1.22-1.65), employee layoffs (HR 1.23, 95% CI 1.03-1.46), and budget cuts (HR 1.19, 95% CI 1.00-1.41) (Figure 8). Associations between organizational changes and psychotropic prescriptions did not vary by sex as indicated by additive (*Synergy Index*: 1.36, 95% CI 0.32-5.84) and multiplicative interaction analyses (p=0.69).

Throughout the year after organizational changes, there was a higher risk of incident IHD after relocation (HR 2.91, 95% CI 1.07-7.90), change in management (HR 2.18, 95% CI 1.02-4.68) and employee layoffs (HR 2.90, 95% CI 1.36-6.16) among employees without preexisting IHD five years prior to the study relative to no change. Adjusting for perceived stress did not reduce these associations notably (Figure 9).

The work-unit level seemed to be important contributors to psychotropic prescriptions and IHD as intraclass correlation coefficients indicated that variation between work units accounted for 6% and 40%, respectively, of the total variance in each outcome.

Figure 8. Adjusted risk of prescriptions for psychotropic medications in 2014 among the employees and 95% confidence intervals associated with specific types of organizational changes occurring in 2013 relative to no changes (references: 1.0).

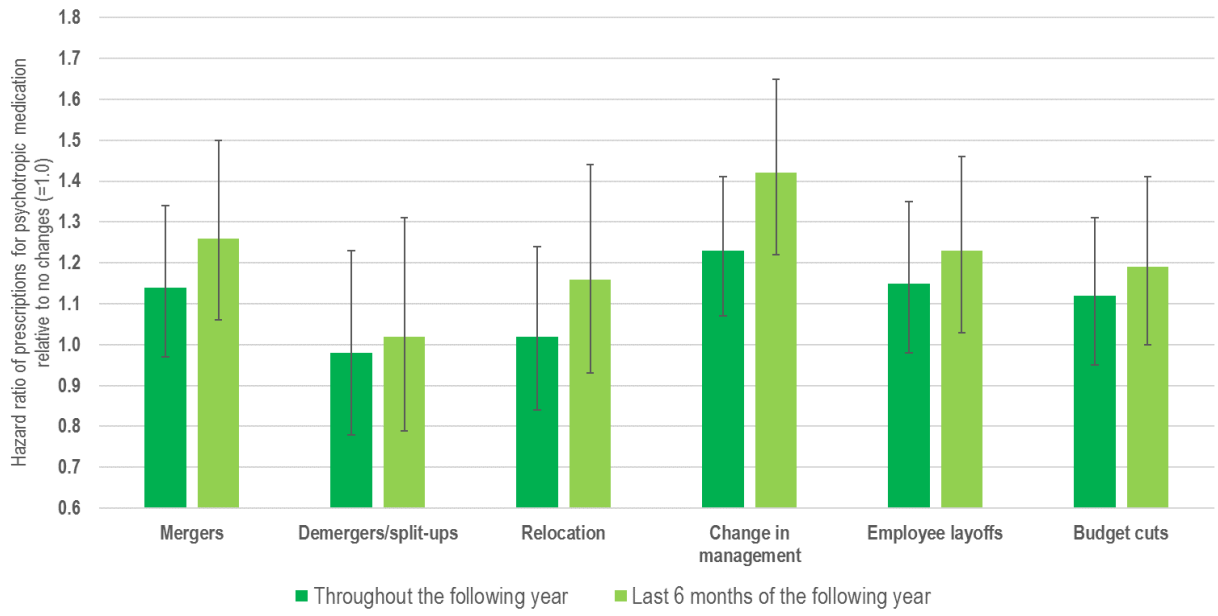
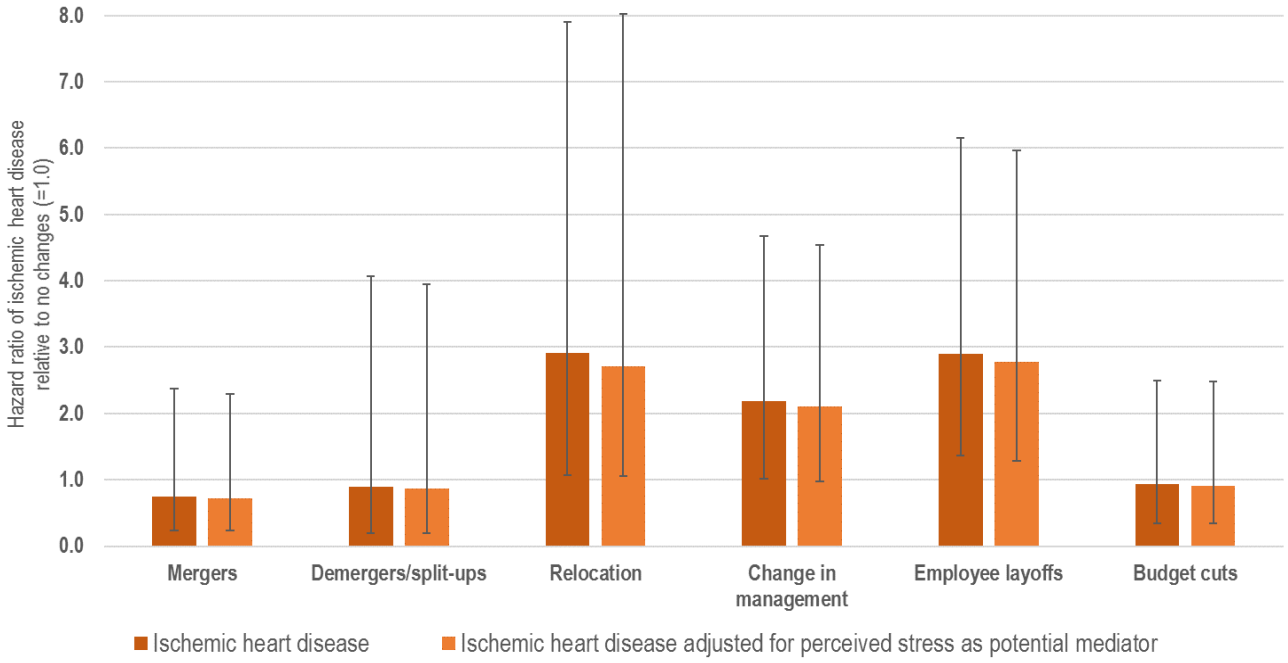


Figure 9. Adjusted relative risk of incident ischemic heart disease (IHD) in 2014 and 95% confidence intervals associated with specific types of organizational changes occurring in 2013 relative to no changes (references: 1.0) among employees without IHD five years prior to observation on exposure.



Discussions

Key findings

This thesis examined the impacts of co-occurring and specific types of organizational changes in the work unit on subsequent employee turnover and health. The underlying psychosocial mechanisms on these associations were also addressed.

In total, 9 of all 14 (64%) main analyses between organizational changes and employee turnover showed statistically significantly higher rate ratios of subsequent employee EFW or non-disability early retirement. The remaining 5 main analyses (36%) did not yield significant associations between organizational changes and employee turnover, although point estimates suggested such positive relation. Adjusting for work-unit social capital (WSC) in the regression models predicting EFW did not notably diminish the rather inconsistent associations with each indicator of organizational changes, suggesting no important mediation – if any – through this single psychosocial factor. However, WSC, organizational justice, and quality of management did somewhat diminish associations between specific types of organizational changes and higher early-retirement rates, suggesting some mediation through these three psychosocial factors combined.

Regarding the employee health outcomes, 25 of all 68 (37%) main analyses showed statistically significantly higher risk of adverse employee health according to the studied indicators of organizational changes relative to no changes. In total, 40 (59%) main analyses revealed no statistically significant associations between changes and health, but only 3 (4%) main analyses showed associations with *lower* risk of adverse health (only in analyses with sickness absence [SA]). Regarding clinical health outcomes, 10 (36%) of the 28 main analyses showed higher relative risk of psychotropic prescriptions or ischemic heart disease (IHD), while the remaining 64% of the analyses yielded insignificant results. Associations with psychotropic prescription were particularly strong in the latter semester of the follow-up period. The findings provided no evidence for differential sex effects on associations with psychotropic prescriptions. There were no convincing indications of perceived stress mediating associations between organizational changes and incident IHD.

In general, the present findings indicate that organizational changes may be associated with higher rates of subsequent employee turnover and higher risk of detrimental employee health relative to employees experiencing no changes. The psychosocial factors presently studied did not seem to have an important role, if any, in mediating these associations. A considerable number of main analyses yielded statistically insignificant findings, which may be due to limited statistical power.

Previous findings and explanations

This is apparently one of the first studies to examine the relative impacts of different types of work-unit organizational changes on subsequent employee turnover and clinical health outcomes among employees using statistical multilevel techniques. The present studies additionally contributed to the literature on the adverse effects of organizational changes by investigating the underlying psychosocial mechanisms using data retrieved from independent sources.

Employee exit from the work unit and non-disability early retirement

Statistically significant rate ratios of employee were similar for employee EFW (HRs ranged 1.1-1.5) as for non-disability early retirement (HRs ranged 1.2-1.4) according to the different types of organizational changes studied. The two employee turnover outcomes were indeed related since retiring senior employees also EFW.

Papers II and IV on employee EFW and early retirement did not account for the multilevel structure in the data. However, this did not seem to pose a problem since estimates of employee EFW in Paper II (any change: HR 1.10, 95% CI 1.01-1.10) were equivalent to the estimates reported in Paper III (vs. HR 1.10, 95% CI 1.01-1.10), which were based on marginal models to account for clustering at the work-unit level. This is, however, contrary to a recent study on organizational changes and mental distress showing that point estimates of associations diminished while the 95% confidence intervals (CI) widened when accounting for clustering at the work-unit level. These data were indeed self-reported,[95] and subjective item responses may more likely cluster within work units than factual EFW behavior.[56,58]

Apparently, only one epidemiological study have examined the relation between organizational changes and early retirement to find that self-reported workplace restructuring was not statistically significantly associated with transition to the Dutch non-disability early

retirement scheme.[77] Indeed, in a qualitative research study among early retirees, organizational changes at work was frequently highlighted as a reason for withdrawing from the labor market.[143]

The finding of excess rate ratios of employee EFW following some indicators of organizational change is concurrent with the existing literature.[70–74] Papers II-III showed that ≥3 changes occurring simultaneously was associated with particularly high rate ratios of EFW in line with prior findings of broader changes having stronger associations with adverse employee outcomes.[93,95,100,144] Hospital mergers were previously found to be associated with higher employee turnover unrelated to health status.[73] This is consistent with the present associations between mergers and higher rates of non-disability early retirement and employee EFW, although there were no data on the reasons for EFW. In some cases, employees may voluntarily EFW as a reaction to changes, whereas in other cases organizational changes may have the explicit or tacit goal of dismissing specific employees.

Sickness absence

It is likely that some employees left the work unit for health reasons[21,76,145] as the studied organizational changes were also associated with higher risk of SA relative to no changes. The present associations with excess SA corroborates with findings from existing publications[78,80,81,84–86,88,90] although inconsistent results have been reported.[62,85,87]
In Paper II, exposure to work-unit mergers was associated with a 1.31-fold higher relative risk of long-term SA of ≥29 days, which is in line with other findings of a 1.05-fold higher relative risk of long-term SA.[84] The higher risk estimate presently demonstrated may, however, be explained by measuring mergers at the work-unit level instead of the hospital level as well as defining long-term SA as ≥29 days instead of ≥91 days.[84]

Employee layoff in the work unit was associated with both 1.31-fold higher risk of long-term SA and 1.16-fold higher rate of total SA-percentage relative to no changes, which is in keeping with findings of downsizings being particularly associated with adverse health relative to other types of changes (e.g., mergers or outsourcing).[89,95] Interestingly, a study found no excess risk of long-term SA among employees according to transfer from public-sector organizations to private companies without staff reductions.[85] This suggests that organizational change with staff downsizings is a particular risk factor for SA among employees relative to other change types.

Employees may not necessarily stay away from work when feeling sick (i.e., sickness presenteeism).[111] Higher presenteeism has been related to loss of productivity and higher employment security[146] as a previous study demonstrated that rates of SA increased when temporary workers were employed permanently.[147] However, the present study population was mostly comprised of permanent employees and the unemployment rate was relatively low during the study period,[148] suggesting that presenteeism was a minor issue.
It has been suggested that about half to two-third of SA from work is due to genuine sickness or injuries.[108–110,149] Unfortunately, there were no data on the reasons for employee SA; however, findings revealed higher relative risk of specific clinical health outcomes following organizational changes as discussed in the following.

Prescriptions for psychotropic medication

Exposure to any organizational changes was associated with a 1.14 times higher relative risk of prescriptions for psychotropic medication through the subsequent year, which corroborates with other studies on organizational changes,[93] including downsizing.[91,97,98] This association was particularly observed for change in management (HR 1.23, 95% CI 1.07-1.41), which has not been demonstrated previously.
Contrary to prior findings,[93,95] a higher number of co-occurring changes was not convincingly associated with higher risks of psychotropic prescriptions, which may be due to limited statistical power. In addition, limited statistical power may also have hampered detection of prescription effects varying by sex. Indeed, these findings of no sex differences corroborate with *post-hoc* results from Paper II on associations with employee EFW and SA as well as other studies on psychotropic prescriptions,[91,97] although stronger prescription effects have been observed among male employees.[98]

The HR point estimates of all types of organizational changes were higher during follow-up in the last six months of the subsequent year compared to the first six months. This points to a general latency period before the observation of excess prescription rates following organizational changes in keeping with other findings for downsizing among employees without history of substantial SA.[91,97] However, conclusions about the duration of the latency period are hampered due to unclarity regarding initiation of the organizational changes studied.

Ischemic heart disease

Paper VI showed about 2.2-2.9 times higher relative risk of incident IHD among employees remaining in the work unit during occurrence of relocation, change in management or employee layoff. There seemed to be no associations with mergers, split-ups or budget cuts; however, this could be observed due to limited statistical power as indicated by the broad 95% CIs.

The present findings are concurrent with five times higher cardiovascular mortality during a four-year follow-up period after major (>18% staff reduction) – but not minor (8-18%) – downsizing relative to no downsizing (<8%) among Finnish municipal employees.[107] Another study also found a five-fold higher mortality from IHD during a 13-month period after closure of a public bus company among male ex-employees in Greece.[103] Möller *et al*.[105] found borderline significant associations between negative appraisals of change of workplace and higher relative risk of myocardial infarction among women only, whereas negative appraisals of conflict at work and increased responsibilities predicted heart attacks statistically significantly among both sexes. Surprisingly, Paper VI found no convincing indications of perceived stress as a mediator between specific types of organizational changes and IHD among employees. Variation between work units explained 40% of incident IHD events. Indeed, this finding may likely reflect factors related to socio-economic status and lifestyle as work units were relatively homogenously composed with respect to occupation.

In sum, each type of organizational change was – to varying extents – associated with higher rates of subsequent employee turnover as well as higher risk of adverse health among employees compared to no changes. Employee layoffs and budget cuts were only statistically significantly associated with excess EFW in the first three months of follow-up in 2014 (Supplementary table S2, Paper III), but it was unclear if these types of changes were associated with non-disability early retirement. Considering findings from previous and the present studies, organizational changes involving employee layoffs seem to be particularly associated with adverse health outcomes among those remaining in the workplace after the changes. Possible psychosocial mechanisms of the demonstrated associations are discussed in the following.

Possible psychosocial mechanisms

Papers III-IV and VI examined whether the longitudinal associations between organizational changes on adverse employee outcomes were mediated by specific employee- and work-unit-level factors in the psychosocial work environment. Apparently, Papers III-IV were the first studies to examine the mediating properties of workplace social capital, quality of management, and organizational justice on the association between organizational changes and employee turnover, including employee EFW and non-disability early retirement.

Paper III provided evidence for excess relative risk of low WSC following organizational changes. Employees within work units may appraise organizational changes as unfair since they may be treated unequally in the change processes: surplus employees may be dismissed, while other employees may be relocated for merger purposes, which could result in change of management. Commitment to the workplace and procedural justice may be diminished if the employees do not understand the rationale for such changes.[92,120,123,150] This may explain findings of ≥3 changes occurring simultaneously being associated with a particularly high employee EFW rate ratio. It is also likely that organizational changes will be accompanied by disruption of social ties, discontinuity of work flows, and lower trust among employees and managers.[120,123,151,152] Low WSC has previously been related to poor employee health, low work engagement, and emotional exhaustion among employees.[48,50,51,53,153] This could motivate the present findings of lower levels of WSC predicting higher rates of both employee EFW and non-disability early retirement.

Despite demonstrations of discrete associations between organizational changes and WSC as well as between WSC and employee EFW, there were no convincing evidence of WSC mediating the rather inconsistent associations between organizational changes and employee EFW. Paper III focused on organizational change and EFW during a two-year study period, but it could be possible that changes in levels of WSC due to reorganizations occur over a longer time span. Although WSC is conceptualized as a characteristic of the work unit, the employee composition may alter because of organizational changes, which could hamper detection of the mediating by WSC, if any. There were, however, some indications that work-unit organizational justice, quality of management, and WSC partially mediated associations with non-disability early retirement among senior employees during a longer follow-up period.

It is believed that job insecurity plays a pivotal role in detrimental health effects following exposure to organizational changes,[63,104] which seem particularly relevant for downsizing or waves of employees layoffs. The mere anticipation of forthcoming organizational changes and fear of job loss have been associated with long-term adverse health outcomes,[94,104,154] pointing to the importance of job uncertainty involved in relation to changes at work. Previous studies by Kivimäki *et al.*[81,82] showed that associations between major downsizing and health status were diminished by about 50% when adjusting for the effects of job security as well as job control and demands, indicating the mediating properties of these psychosocial factors.

It is reasonable to assume that job strain and job insecurity and may also mediate effects of other types of organizational changes than major downsizing.[66,155] Demands for high quality patientcare may not be adjusted according to staff reductions or during a workplace relocation, which could result in greater workload intensification, longer working hours, and, eventually, higher SA among employees remaining in the given work unit. In addition, change in management and selective budget cuts may induce anxiety about one's future job situation, which can lead to excess mental health problems and higher use of psychotropic medication among employees as suggested by findings in Paper V. Managers may have a key role in maintaining a healthy psychosocial work environment,[156] which may explain why change in management was particularly related to psychotropic prescriptions among employees compared to other types of organizational changes.

Psychological stress at work has been highlighted as a risk factor for development of IHD;[12,38] however, Paper VI did not provide evidence of the mediating properties of perceived stress as mediator on the association between organizational changes and IHD. Indeed, this may be due to using a single-item measure for perceived stress in combination with the observation of few incidents cases of IHD (n=49) introducing limited variation in the data for detection of mediation of effects via perceived stress. Employee perceived stress was measured through March 2014 during follow-up on IHD from 1 January to 31 December 2014; however, postponing start of follow-up to 1 April 2014 (following psychosocial assessment) yielded similar indications of no mediation of IHD effects through perceived stress (data not shown).

There may be multiple plausible psychosocial pathways from organizational changes to adverse employee health and exit from the workplace. Yet the present Papers III-IV and VI

did not provide convincing evidence for WSC and perceived stress as potential mediators of employee turnover and health outcomes, which might be due to methodological reasons. Employees with a preexisting high level of stress prior to organizational change may have fewer mental resources to cope with changing working conditions while maintaining job demands.[34,157,158] Thus, in line with prior findings,[36,61] it is likely that employee health and turnover effects of organizational changes are modified by baseline psychosocial factors, such as social support,[26,159] effort-reward imbalance[79] or WSC.[125] However, such potential effect modification of the psychosocial work environment was not addressed in Papers II-VI, because the psychosocial factors were measured after occurrence of the organizational changes and, thus, likely to be affected by the changes.

Confounding and reverse causation

Organizational changes may be *associated* with higher risk of employee turnover and detrimental health, but association alone is insufficient to infer that organizational changes have a *causal* impact on adverse employee outcomes. In fact, associations could be observed due to residual confounding by factors that influences both the exposure variable (e.g., organizational changes) and the outcome variable (e.g., employee turnover, adverse health).[160] There were, however, no considerable differences in characteristics of the study population and employees exposed to any organizational changes, indicating that confounding was not a major issue.

Psychosocial factors may be regarded as mediators but also confounders of the relationship between changes and employee turnover/health, since a poor a psychosocial work environment may give rise to changes. However, given that WSC is robust against changes over a short-term period (as discussed above), psychosocial factors may not have confounded associations notably as associations with employees EFW did not seem to be convincingly influenced by adjustment of WSC.

It is likely that leadership styles and manager personalities at the work-unit level may influence employee outcomes;[161] however, most change initiatives are decided on higher political and top management levels (mergers, demergers/split-ups, relocation, etc.), and therefore confounding from these factors are not considered likely in the present context.

Data on *preceding* organizational changes were available in Papers II-III and V-VI, although these were not used for adjustment purposes. However, due to the generally high rate of

employee EFW (17%), many employees may not have been exposed to preceding organizational changes in their work unit.

Another explanation of the present associations may be due to reverse causality; that is, high employee turnover and adverse health among employees causing work-unit organizational changes. For example, work units with high rates of SA may have a low productivity rate, which could encourage reorganization of the work unit. However, considering the previous theoretical and empirical literature as well as the consistency in the present findings, the presence of reverse causality from excess work-unit turnover rates or adverse health on organizational changes is regarded as unlikely in the present study.

Methodological considerations

A potential methodological limitation of Papers II-VI may be the relatively short follow-up periods applied with baseline after the observations on organizational changes, which could have underestimated associations. Adverse health and turnover effects of organizational changes could be observed among employees already when rumors about forthcoming changes at work start to spread.[91,94,97,106] The managers provided information on occurrence of organizational changes and not their initiation or announcement within work units. Further, it is likely that organizational changes may be associated with detrimental employee outcomes beyond one year of follow-up. This limitation seemed relevant for Paper V, since the findings indicated a latency period before observation of higher relative risk of psychotropic prescriptions. However, employee EFW and health outcomes were not examined in as such associations would be confounded by organizational changes occurring in 2014, on which there were no data. Likewise, organizational changes initiated during the present follow-up periods (2011-2012 and 2014) may have underestimated the findings.

Data on occurrence of organizational changes were obtained via email surveys administered to the managers, because there were no records on work-unit reorganization in the regional registers. This approach may be a potential limitation since 31-41% of the managers did not respond to the questionnaire on organizational changes. Organizational changes could give rise to managers exiting from the Capital Region of Denmark and, thus, being unable to provide data on changes in the surveys. Yet working email addresses were not renewed if the managers changed workplace within the Capital Region of Denmark. Missing data on

organizational changes was not considered as a major issue since characteristics among the eligible population (with incomplete data on changes) and the study population were similar. Employee turnover rates were somewhat lower in the study population, suggesting some underestimation of findings with employee EFW and non-disability early retirement.
The applied data on organizational changes were obtained three or four years after their occurrence, which could introduce recall bias; however, it is likely that the managers executed the organizational changes themselves and, thus, potential recall bias is regarded as minor. Finally, it was a limitation that the psychosocial composite scales applied did not originate from validated questionnaires measuring all aspects of the psychosocial factors. However, the majority of the items were retrieved from the Copenhagen Psychosocial Questionnaire,[134] and high alpha values and factor analyses indicated the reliability and validity of the scales.

Strengths of this thesis include the large study populations with complete data on follow-up and background information among all relevant employees. In addition, data on exposure, outcome, and mediators were retrieved from independent sources, and therefore common-method bias is not considered as a problem. This is particularly important in mediation analysis as spurious reductions in point estimates could be observed due to common variance from applying the same method for data gathering.[56] Moreover, all data were retrieved from reliable sources, including regional and national registers as well as managers responding to a few simple-phrased items regarding factual change events in their work unit.

It was also a strength that assessments of the psychosocial work environment were based on surveys with high response rates (81-84%). Moreover, analyzing psychosocial scores aggregated at the work-unit level, which were assigned to both respondents and non-respondents, reduced selection bias introduced by employees who did not participate in the work-environment surveys. In addition, psychosocial factors aggregated at the work-unit level may likely be less influenced by employee-level factors, such as personality or social desirability, that could also affect employee outcomes (e.g., employee turnover).[56]

Examining several types of organizational changes at work-unit level was an additional strength of the studies. The work-unit approach ensured that the employees did experience the organizational changes since only employees working in the same work unit during observation on changes were included. Finally, assessment of several types of organizational changes enhanced the purity of the reference group of employees not exposed to any changes.

Representativeness and generalizability

The source population included all employees in the Capital Region of Denmark, but a selection of healthy workers could be introduced if previous organizational changes had removed unhealthy employees from the population.[36] Indeed, this potential selection bias do not seem relevant as organizational change is considered as a characteristic of modern work life. A considerable proportion of eligible employees were excluded due to missing data on organizational changes, which could bias representativeness. However, the inclusion criteria and missingness on organizational changes did not seem to play noteworthy roles in the representativeness of the study population (e.g., see Papers II and V).

The eligible populations included employees who worked at least 18.5 hours per week in the same work unit throughout one year as well as senior employees eligible for early retirement during follow-up. With application of these inclusion criteria, many temporary employees (e.g., trainees, students) were excluded from the study. However, since these non-eligible employees did not work on a regular basis in the work unit during the observation on organizational changes, it was unclear if the employees excluded were even affected by the studied changes. Eligible employees who left the work unit during the observation on organizational changes (e.g., potentially due to the changes studied) may potentially introduce selection of healthy workers into the study population, which could underestimate the findings. There were, however, no data on the reasons for employee EFW to evaluate this potential bias.

The study population mainly comprised female employees. The underlying adverse (psychosocial) mechanisms may differ by sex, although the present findings did not provide evidence for differential sex effects. The high proportion of female employees is a general characteristic of the healthcare sector, and generalizations of the findings to other public-sector enterprises should be made with caution.

Organizational changes are often implemented as rationalization strategies in public and private sector workplaces, but the underlying psychosocial mechanisms among employees may likely differ between the two sectors (e.g., job security, effort-reward). It is plausible that the financial crisis of 2008 may have contributed to excess fear of job loss in the study period

from 2009 to 2014. However, working in the Danish healthcare sector is traditionally considered as a secure and stable employment, and excess fear of job loss may have been most pronounced among employees in the private sector.

Finally, the presented results are concurrent with prior findings of population-based studies of public and private sectors in Denmark and Sweden.[89,91,93,97] This supports that the findings of this thesis are generalizable to other occupational contexts than the Capital Region of Denmark. Generalizability is further supported by the consistency in the findings of organizational change as risk factor for different adverse employee outcomes all related to high levels of psychological stress.

Conclusions

This thesis demonstrated longitudinal associations between six types of organizational changes in the work unit (i.e. mergers, demergers/split-ups, relocation, change in management, employee layoff, budget cuts) and higher rate ratios of subsequent employee turnover as well as higher risk of detrimental health outcomes among employees relative to no changes. Specifically, there was up to 50% higher rate ratio/relative risk of subsequent employee exit from the work unit, non-disability early retirement (Danish: "*efterløn*"), sickness absence, and prescriptions for psychotropic medication, whereas 120-190% higher relative risk of incident ischemic heart disease. Bias and confounding were not considered as likely explanations of these findings.

There was no strong evidence of specific types of organizational change being particularly associated with all the employee outcomes studied, yet organizational changes involving employee layoffs were more consistently associated with higher relative risk of detrimental health among employees. A greater number of organizational changes occurring simultaneously was not consistently associated with more adverse health, but there were indications of a particularly high rate ratio of employee exit from the work unit. Some evidence suggested that specific indicators of organizational change were related to specific employee outcomes; however, more research is needed to support this. Findings on associations with prescriptions for psychotropic medication pointed to a latency period before the observation of adverse mental health effects.

Organizational change in the work unit was associated with higher relative risk of low work-unit social capital. Lower levels of work-unit social capital, quality of management, and organizational justice were associated with higher rate ratios of employee turnover. The present thesis did not provide convincing evidence of work-unit social capital as a mediator on the associations between organizational changes and employee turnover. There were indeed indications that the combination of work-unit social capital, quality of management, and organizational justice explained some of the association between specific types of organizational change and higher rate ratios of non-disability early retirement.

It is time for policy and decision makers to consider adverse impacts of organizational changes on the employees. Findings from this thesis indicate that organizational change is a substantial and unneglectable characteristic of modern work life, since about half of the employees were exposed to any changes during a one-year period. Excess rates of employee

turnover and sickness absence as well as physical and mental illness may not only be a burden to the individual, but also to society in terms of excessive costs related to loss of productivity, healthcare treatment, and public transfer payments.

Perspectives

Provided there is a causal effect of organizational changes on excess employee turnover and adverse employee health, perspectives for diminishing such detrimental effects are outlined in the following. As for the theories on work-related stress, there seem neither to be consensus about a general approach to mitigate negative employee effects of organizational changes.
A review on interventions to reduce job stress concluded that a combination of employee- and organization-focused initiatives had the most promising effect.[162] This suggests that it is important to consider preservation of employee well-being at the organizational level when planning and executing reorganizations.
In line with the job demand-control-support model[26] and empirical findings from a workplace closure,[159] social support from the colleagues and immediate managers may mitigate negative effects of organizational changes among employees. In addition, involvement of employees to influence and participate in the change process may increase job control and diminish job strain.[61,162] Such involvement could, for example, include employee influence on the initiation date of the changes, future workplace location, and activities for skill development. Employee prospects of redundancy in the post-changed workplace due to lack of skills could give rise to higher job insecurity and increase competition among colleagues for keeping their job.
Detrimental effects of organizational changes could also be reduced by realistically adjusting demands for productivity and quality of service to the capabilities of the employees during a reorganization process.[61]

Organizational change at work may include many hierarchical levels, and it is reasonable to expect a psychosocial spillover effect from reorganized work units to other immediate work units (e.g., within the same department). These spillover effects could, for example, include workload intensification, perceived unfairness towards colleagues, and anticipation of future changes or downsizing waves ("*Will it be us next time?*"). Interventions to diminish detrimental outcomes of organizational changes should not only target those within the work unit undergoing changes, but also employees and managers in other relevant workplace entities. Previous studies concluded that the mere anticipation of organizational changes was associated with negative employee outcomes,[94,104,154] and managerial communication to all relevant employees about change prospects may reduce job insecurity in this regard.[150,163]
Although reorganization may lead to positive changes (e.g., improved work environment, opportunities for promotion, skill development etc.) people tend, in general, to avoid losses

over obtaining equivalent gains,[164] which could explain the excessive employee focus on negative expectations to changes at work. Indeed, negative expectations among employees may also be shaped by internal contextual factors,[118] such as the organizational history of prior restructuring events.[100]

A prerequisite for mitigating stress-related effects of organizational change is that managers and decision makers are aware of the occupational hazards of organizational change, the psychosocial dynamics involved in such changes, and possible options for effective prevention strategies. However, in a recent survey among members of the Danish Association of Managers, 61% responded that they were "*to some extent*" or "*to a little extent/not at all*" suited for dealing with stress-related problems among employees, while 96% considered it as part of their management task to deal with employee stress. Further, only 28% responded that their workplace offered skill-discretion activities to their managers for prevention or management of employee stress.[165] This points to a need for systematically increasing managers' level of competency in dealing with work-related stress to ensure a healthy psychosocial work environment for their subordinates as well as themselves.

Future research

It remains as a key objective for future research to understand how negative (as well as positive) effects of organizational changes develop. Employees may react differently to different types of organizational changes, and future research will likely benefit from focusing on specific change types and their content. In this regard, it seems imperative to measure the organizational changes at a lower level in the hierarchical workplace structure to establish such detailed exposure measure. To better assess immediate and temporality in employee outcomes, baseline should be set at the exact time point when prospects of organizational changes were known among employees. It may, however, be practically challenging to define an exact onset of organizational change for all employees, since rumors about forthcoming changes may spread within the workplace even before an official announcement.

In addition, the implementation of organizational changes may be important for the psychosocial and health repercussions among employees. Previous studies have demonstrated that redeploying and supporting redundant staff were with greater psychological well-being.[92,166] Few epidemiological studies have studied employee impacts of the manner in

which the organizational changes are executed. The literature has predominantly focused on employees as passive recipients of organizational change. Thus, there is a need for elucidating how employees actively cope with changes at work[167] and under which circumstances positive employee outcomes are observed.[168]

Also, the various complex processes of organizational changes unfolding over time has received undeservedly scarce attention within occupational health research; however, this complexity should be reflected in future occupational health research to gain a better understanding of the effects of organizational change. It seems reasonable that certain stages during a change process may be particularly relevant for adverse employee health and turnover.[158] Elucidating such pivotal stages during the change process may qualify the optimal time points for initiating interventions to diminish negative employee effects.

Finally, more empirical research studies should examine the mediating as well as moderating factors of organizational change on employee turnover and health. A better understanding of such factors may likely depart from mixed methods research to integrate qualitative aspects (e.g., of contextual factors that facilitate or hinder change implementation) and generalizability of the findings.[167] Psychosocial factors with such mediating and/or moderating properties may comprise specific targets for consideration when planning and executing organizational changes to hamper negative employee effects. In this regard, workplace social capital seems a promising target of organizational intervention as an increasing body of evidence highlights this psychosocial factor as an important determinant for health and well-being among employees. However, more research is required to evaluate organizational change as a long-term risk factor for low workplace social capital.

References

1. Gaynor M, Laudicella M, Propper C. Can governments do it better? Merger mania and hospital outcomes in the English NHS. *J Health Econ*. 2012;**31**(3):528–543.
2. European Foundation for the Improvement of Living and Working Conditions (Eurofound). ERM annual report 2014: restructuring in the public sector. Publications Office of the European Union, Luxembourg; 2015.
3. Gay P du, Vikkelsø S. Reflections: On the Lost Specification of 'Change'. *J Chang Manag*. 2012;**12**(2):121–143.
4. Kompier MA. New systems of work organization and workers' health. *Scand J Work Environ Health*. 2006;**32**(6):421–430.
5. Finansministeriet. Sygehusene fritages for produktivitetskrav i 2018 [Internet]. 2017 [cited 2018 Nov 29]. Available from: https://www.fm.dk/nyheder/pressemeddelelser/2017/10/sygehusene-fritages-for-produktivitetskrav-i-2018
6. Smaglik P. Job movements. *Nature*. 2005;**433**(7028):901.
7. Ven AH. van de, Poole MS. Explaining Development and Change in Organizations. *Acad Manag Rev*. 1995;**20**(3):510–540.
8. European Foundation for the Improvement of Living and Working Conditions (Eurofound). Third European Company Survey – Overview report: Workplace practices – Patterns, performance and well-being [Internet]. 2015. Available from: http://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1502en_0.pdf
9. European Foundation for the Improvement of Living and Working Conditions (Eurofound). Sixth European Working Conditions Survey – Overview report, Publications Office of the European Union, Luxembourg. [Internet]. 2016. Available from: https://www.eurofound.europa.eu/data/european-working-conditions-survey?locale=EN&dataSource=EWCS2016&media=png&width=740&question=y15_Q88&plot=euBars&countryGroup=linear&subset=agecat_3&subsetValue=All
10. Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. *JAMA Am Med Assoc*. 2007;**298**(14):1685–1687.
11. Schnall PL, Dobson M, Landsbergis P. Globalization, Work, and Cardiovascular Disease. *Int J Heal Serv*. 2016;**46**(4):656–692.
12. Kivimäki M, Kawachi I. Work Stress as a Risk Factor for Cardiovascular Disease. *Curr Cardiol Rep*. 2015;**17**(9).
13. Stansfeld S, Candy B. Psychosocial work environment and mental health - A meta-analytic review. *Scand J Work Environ Heal*. 2006;**32**(6):443–462.
14. Wang H, Naghavi M, Allen C, et al. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;**388**(10053):1459–1544.
15. Vos T, Allen C, Arora M, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;**388**(10053):1545–1602.
16. Hassard J, Teoh KRH, Visockaite G, Dewe P, Cox T. The cost of work-related stress to society: A systematic review. *J Occup Health Psychol*. 2018;**23**(1):1–17.
17. Gimeno D, Benavides FG, Benach J, Amick BC. Distribution of sickness absence in the European Union countries. *Occup Environ Med*. 2004;**61**(10):867–869.
18. Henderson M, Glozier N, Elliot KH. Long term sickness absence. *BMJ Br Med J*.

2005;**330**(April):802–3.
19. Krane L, Johnsen R, Fleten N, et al. Sickness absence patterns and trends in the health care sector: 5-year monitoring of female municipal employees in the health and care sectors in Norway and Denmark. *Hum Resour Health*. 2014;**12**(1):1–8.
20. Kouwenhoven-Pasmooij TA, Burdorf A, Roos-Hesselink JW, Hunink MGM, Robroek SJW. Cardiovascular disease, diabetes and early exit from paid employment in Europe; The impact of work-related factors. *Int J Cardiol*. Elsevier Ireland Ltd; 2016;**215**(2016):332–337.
21. Rijn RM Van, Robroek SJW, Brouwer S, Burdorf A. Influence of poor health on exit from paid employment: A systematic review. *Occup Environ Med*. 2014;**71**(4):295–301.
22. Hayes LJ, O'Brien-Pallas L, Duffield C, et al. Nurse turnover: A literature review - An update. *Int J Nurs Stud*. Elsevier Ltd; 2012;**49**(7):887–905.
23. O'Brien-Pallas L, Murphy GT, Shamian J, Li X, Hayes LJ. Impact and determinants of nurse turnover: A pan-Canadian study. *J Nurs Manag*. 2010;**18**(8):1073–1086.
24. Waldman JD, Kelly F, Arora S, Smith HL. The shocking cost of turnover in health care. *Health Care Manage Rev*. 2010;**35**(3):206–211.
25. Sanderson WC, Scherbov S. Remeasuring aging. *Science (80-).* 2010;**329**(5997):1287–1288.
26. Karasek RA, Theorell T. Healthy Work: Stress, Productivity, and the Reconstruction of Working Life. New York: Basic Books; 1990.
27. Karasek RA. Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. *Adm Sci Quaterly*. 1979;**24**(2):285–308.
28. Elovainio M, Kivimäki M, Vahtera J. Organizational justice: Evidence of a new psychosocial predictor of health. *Am J Public Health*. 2002;**92**(1):105–108.
29. Ndjaboué R, Brisson C, Vézina M. Organisational justice and mental health: a systematic review of prospective studies. *Occup Environ Med*. 2012;**69**(10):694–700.
30. Cohen-Charash Y, Spector PE. The role of justice in organizations: A meta-analysis. *Organ Behav Hum Decis Process*. 2001;**86**(2):278–321.
31. Kawachi I, Berkman L. Social Capital, Social Cohesion, and Health. In: Berkman L, Kawachi I, Glymour M, editors. *Soc Epidemiol*. 2nd ed. 2014. p. 290–319.
32. Kawachi I, Kim D, Coutts A, Subramanian S V. Commentary: Reconciling the three accounts of social capital. *Int J Epidemiol*. 2004;**33**(4):682–690.
33. Siegrist J. Adverse health effects of high effort-low reward conditions at work. *J Occup Heath Psychol*. 1996;(1):27–43.
34. Bakker A, Demerouti E. Job Demands–Resources Theory: Taking Stock and Looking Forward Arnold. *J Occup Health Psychol*. 2017;**22**(3):273–285.
35. Cheng GHL, Chan DKS. Who suffers more from job insecurity? A meta-analytic review. *Appl Psychol*. 2008;**57**(2):272–303.
36. Quinlan M, Bohle P. Overstretched and unreciprocated commitment: Reviewing research on the occupational health and safety effects of downsizing and job insecurity. *Int J Heal Serv*. 2009;**39**(1):1–44.
37. Richardson S, Shaffer JA, Falzon L, Krupka D, Davidson KW, Edmondson D. Meta-analysis of perceived stress and its association with incident coronary heart disease. *Am J Cardiol*. Elsevier Inc.; 2012;**110**(12):1711–1716.
38. Kivimäki M, Steptoe A. Effects of stress on the development and progression of cardiovascular disease. *Nat Rev Cardiol*. 2018;**15**:215–229.
39. Kivimäki M, Nyberg ST, Batty GD, et al. Job strain as a risk factor for coronary heart disease: A collaborative meta-analysis of individual participant data. *Lancet*. 2012;**380**(9852):1491–1497.
40. Rod NH, Grønbæk M, Schnohr P, Prescott E, Kristensen TS. Perceived stress as a risk

factor for changes in health behaviour and cardiac risk profile: A longitudinal study. *J Intern Med*. 2009;**266**(5):467–475.
41. Li J, Zhang MIN, Loerbroks A, Angerer P, Siegrist J. Work Stress And The Risk Of Recurrent Coronary Heart Disease Events: A Systematic Review And Meta-Analysis. *Int J Occup Med Environ Health*. 2015;**28**(1):8–19.
42. Bonde JPE. Psychosocial factors at work and risk of depression: A systematic review of the epidemiological evidence. *Occup Environ Med*. 2008;**65**(7):438–445.
43. Netterstrøm B, Conrad N, Bech P, et al. The relation between work-related psychosocial factors and the development of depression. *Epidemiol Rev*. 2008;**30**(1):118–132.
44. Jensen HK, Wieclaw J, Munch-Hansen T, Thulstrup AM, Bonde JP. Does dissatisfaction with psychosocial work climate predict depressive, anxiety and substance abuse disorders? A prospective study of Danish public service employees. *J Epidemiol Community Health*. 2010;**64**(9):796–801.
45. Wieclaw J, Agerbo E, Bo Mortensen P, Burr H, Tuchsen F, Bonde JP. Psychosocial working conditions and the risk of depression and anxiety disorders in the Danish workforce. *BMC Public Health*. 2008;**8**:1–9.
46. Åkerstedt T, Garefelt J, Richter A, et al. Work and Sleep—A Prospective Study of Psychosocial Work Factors, Physical Work Factors, and Work Scheduling. *Sleep*. 2015;**38**(7):1129–1136.
47. Laethem M Van, Beckers DG, Kompier MA, Dijksterhuis A, Geurts SA. Psychosocial work characteristics and sleep quality: a systematic review of longitudinal and intervention research. *Scand J Work Environ Health*. 2013;**39**(6):535–549.
48. Bogaert P Van, Kowalski C, Weeks SM, heusden D Van, Clarke SP. The relationship between nurse practice environment, nurse work characteristics, burnout and job outcome and quality of nursing care: A cross-sectional survey. *Int J Nurs Stud*. Elsevier Ltd; 2013;**50**(12):1667–1677.
49. Kowalski C, Driller E, Ernstmann N, et al. Associations between emotional exhaustion, social capital, workload, and latitude in decision-making among professionals working with people with disabilities. *Res Dev Disabil*. 2010;**31**(2):470–479.
50. Driller E, Ommen O, Kowalski C, Ernstmann N, Pfaff H. The relationship between social capital in hospitals and emotional exhaustion in clinicians: A study in four German hospitals. *Int J Soc Psychiatry*. 2011;**57**(6):604–609.
51. Oksanen T, Kawachi I, Jokela M, et al. Workplace social capital and risk of chronic and severe hypertension: A cohort study. *J Hypertens*. 2012;**30**(6):1129–1136.
52. Rugulies R, Hasle P, Pejtersen JH, Aust B, Bjorner JB. Workplace social capital and risk of long-term sickness absence. Are associations modified by occupational grade? *Eur J Public Health*. 2016;**26**(2):328–333.
53. Török E, Clark AJ, Jensen JH, et al. Work-unit social capital and long-term sickness absence: A prospective cohort study of 32 053 hospital employees. *Occup Environ Med*. 2018;**75**:623–629.
54. Suadicani P, Bonde JP, Olesen K, Gyntelberg F. Job satisfaction and intention to quit the job. *Occup Med (Chic Ill)*. 2013;**63**(2):96–102.
55. Josephson M, Lindberg P, Voss M, Alfredsson L, Vingård E. The same factors influence job turnover and long spells of sick leave - A 3-year follow-up of Swedish nurses. *Eur J Public Health*. 2008;**18**(4):380–385.
56. Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol*. 2003;**88**(5):879–903.
57. Kasl S. Measuring Job Stressors and Studying the Health Impact of the Work Environment: An Epidemiologic Commentary. *J Occup Health Psychol*.

1998;**34**(4):390–401.
58. Spector PE. Method variance in organizational research: Truth or urban legend? *Organ Res Methods*. 2006;**9**(2):221–232.
59. Mellenbergh GJ. Item bias and item response theory. *Int J Educ Res*. 1989;**13**(2):127–143.
60. Westgaard RH, Winkel J. Occupational musculoskeletal and mental health: Significance of rationalization and opportunities to create sustainable production systems - A systematic review. *Appl Ergon*. Elsevier Ltd; 2011;**42**(2):261–296.
61. Jong T de, Wiezer N, Weerd M de, Nielsen K, Mattila-Holappa P, Mockałło Z. The impact of restructuring on employee well-being: a systematic review of longitudinal studies. *Work Stress*. 2016;**30**(1):91–114.
62. Wahlstedt KGI, Edling C. Organizational changes at a postal sorting terminal - their effects upon work satisfaction, psychosomatic complaints and sick leave. *Work Stress*. 1997;**11**(3):279–291.
63. Bordia P, Hobman E, Jones E, Gallois C, Callan VJ. Uncertainty during organizational change: Types, consequences, and management strategies. *J Bus Psychol*. 2004;**18**(4):507–532.
64. Oreg S, Vakola M, Armenakis A. Change recipients' reactions to organizational change: A 60-year review of quantitative studies. *J Appl Behav Sci*. 2011;**47**(4):461–524.
65. Kernan MC, Hanges PJ. Survivor reactions to reorganization: Antecedents and consequences of procedural, interpersonal, and informational justice. *J Appl Psychol*. 2002;**87**(5):916–928.
66. Rafferty AE, Griffin MA. Perceptions of organizational change: A stress and coping perspective. *J Appl Psychol*. 2006;**91**(5):1154–1162.
67. Knudsen HK, Johnson JA, Martin JK, Roman PM. Downsizing survival: The experience of work and organizational commitment. *Sociol Inq*. 2003;**73**(2):265–283.
68. Thorsen SV, Jensen PH, Bjørner JB. Psychosocial work environment and retirement age: a prospective study of 1876 senior employees. *Int Arch Occup Environ Health*. 2016;**89**(6):891–900.
69. Bamberger SG, Vinding AL, Larsen A, et al. Impact of organisational change on mental health: a systematic review. *Occup Environ Med*. 2012;**69**(8):592–598.
70. Baron JN, Hannan MT, Burton MD. Labor Pains: Change in Organizational Models and Employee Turnover in Young, High-Tech Firms. *Am J Sociol*. 2001;**106**(4):960–1012.
71. Bauer TK, Bender S. Technological change, organizational change, and job turnover. *Labour Econ*. 2004;**11**(3):265–291.
72. Cameron K, Kim M, Whetten D. Organizational Effects of Decline and Turbulence. *Adm Sci Quaterly*. 1987;**32**(2):222–240.
73. Ingelsrud MH. Hospital Mergers in Norway: Employee Health and Turnover to Three Destinations. *Nord J Work Life Stud*. 2017;**7**(1):107–124.
74. Probst TM. Exploring employee outcomes of organizational restructuring: A solomon four-group study. *Gr Organ Manag*. 2003;**28**(3):416–439.
75. Sylling PW, Wong ES, Liu C-F, et al. Patient-Centered Medical Home Implementation and Primary Care Provider Turnover. *Med Care*. 2014;**52**(12):1017–1022.
76. Vahtera J, Kivimäki M, Forma P, et al. Organisational downsizing as a predictor of disability pension: The 10-town prospective cohort study. *J Epidemiol Community Health*. 2005;**59**(3):238–242.
77. Wind A de, Geuskens GA, Ybema JF, et al. Health, job characteristics, skills, and social and financial factors in relation to early retirement - Results from a longitudinal study in the Netherlands. *Scand J Work Environ Heal*. 2014;**40**(2):186–194.

78. Bernstrøm VH, Kjekshus LE. Effect of organisational change type and frequency on long-term sickness absence in hospitals. *J Nurs Manag*. 2015;**23**(6):813–822.
79. Dragano N, Verde PE, Siegrist J. Organisational downsizing and work stress: Testing synergistic health effects in employed men and women. *J Epidemiol Community Health*. 2005;**59**(8):694–699.
80. Ingelsrud MH. Reorganization increases long-term sickness absence at all levels of hospital staff: panel data analysis of employees of Norwegian public hospitals. *BMC Health Serv Res*. 2014;**14**:411.
81. Kivimäki M, Vahtera J, Pentti J, Ferrie JE. Factors underlying the effect of organisational downsizing on health of employees: longitudinal cohort study. *BMJ*. 2000;**320**(8):971–975.
82. Kivimäki M, Vahtera J, Pentti J, Thomson L, Griffiths A, Cox T. Downsizing, changes in work, and self-rated health of employees: A 7-year 3-wave panel study. *Anxiety, Stress Coping*. 2001;**14**(1):59–73.
83. Kivimäki M, Vahtera J, Elovainio M, Pentti J, Virtanen M. Human costs of organizational downsizing: Comparing health trends between leavers and stayers. *Am J Community Psychol*. 2003;**32**(1–2):57–67.
84. Kjekshus LE, Bernström VH, Dahl E, Lorentzen T. The effect of hospital mergers on long-term sickness absence among hospital employees: a fixed effects multivariate regression analysis using panel data. *BMC Heal Serv Res*. 2014;**14**:50.
85. Kokkinen L, Virtanen M, Pentti J, Vahtera J, Kivimäki M. Does transfer of work from a public sector organisation to a commercial enterprise without staff reductions increase risk of long-term sickness absence among the staff ? A cohort study of laboratory and radiology employees. 2013;8–11.
86. Røed K, Fevang E. Organizational Change, Absenteeism, and Welfare Dependency. *J Hum Ressources*. 2007;**42**(1):156–193.
87. Theorell T, Oxenstierna G, Westerlund H, Ferrie JE, 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.
88. Vahtera J, Kivimäki M, Pentti J. Effect of organisational downsizing on health of employees. *Lancet*. 1997;**350**(9085):1124–1128.
89. 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):1193–1197.
90. Østhus S, Mastekaasa A. The impact of downsizing on remaining workers' sickness absence. *Soc Sci Med*. 2010;**71**(8):1455–1462.
91. Blomqvist S, Alexanderson K, Vahtera J, Westerlund H, Hanson LM. Downsizing and purchases of psychotropic drugs: A longitudinal study of stayers, changers and unemployed. *PLoS One*. 2018;**13**(8):e0203433.
92. Brenner MH, Andreeva E, Theorell T, et al. Organizational downsizing and depressive symptoms in the European recession: The experience of workers in France, Hungary, Sweden and the United Kingdom. *PLoS One*. 2014;**9**(5).
93. Dahl MS. Organizational Change and Employee Stress. 2011;**57**(2):240–256.
94. Falkenberg H, Fransson EI, Westerlund H, Head JA. Short- and long-term effects of major organisational change on minor psychiatric disorder and self-rated health: Results from the Whitehall II study. *Occup Environ Med*. 2013;**70**(10):688–696.
95. Fløvik L, Knardahl S, Christensen JO. Organizational change and employee mental health: A prospective multilevel study of the associations between organizational changes and clinically relevant mental distress. *Scand J Work Environ Health*. 2018;(online first):1–12.
96. Greubel J, Kecklund G. The impact of organizational changes on work stress, sleep,

recovery and health. *Ind Health*. 2011;**49**(3):353–364.
97. Hanson LLM, Westerlund H, Chungkham HS, Vahtera J, Sverke M, Alexanderson K. Purchases of prescription antidepressants in the Swedish population in relation to major workplace downsizing. *Epidemiology*. 2016;**27**(2):257–264.
98. Kivimäki M, Honkonen T, Wahlbeck K, et al. Organisational downsizing and increased use of psychotropic drugs among employees who remain in employment. *J Epidemiol Community Heal*. 2007;**61**(2):154–158.
99. Loretto W, Platt S, Popham F. Workplace change and employee mental health: results from a longitudinal study. *Br J Manag*. 2010;**21**(2):526–540.
100. Moore S, Grunberg L, Greenberg E. Surviving repeated waves of organizational downsizing: The recency, duration, and order effects associated with different forms of layoff contact. *Anxiety, Stress Coping*. 2006;**19**(3):309–329.
101. Netterstrøm B, Blønd M, Nielsen M, Rugulies R, Eskelinen L. Development of depressive symptoms and depression during organizational change – a two-year follow-up study of civil servants. *Scand J Work Environ Health* [Internet]. 2010;**36**(6):445–448. Available from: http://www.sjweh.fi/show_abstract.php?abstract_id=3075
102. Väänänen A, Ahola K, Koskinen A, Pahkin K, Kouvonen A. Organisational merger and psychiatric morbidity: A prospective study in a changing work organisation. *J Epidemiol Community Health*. 2011;**65**(8):682–687.
103. Drivas S, Rachiotis G, Stamatopoulos G, Hadjichristodoulou C, Chatzis C. Company closure and mortality in a Greek bus company. *Occup Med (Chic Ill)*. 2013;**63**(3):231–233.
104. Ferrie JE, Shipley MJ, Marmot MG, Stansfeld S, Smith GD. The Health Effects of Major Organisational Change and Job Insecurity. *Soc Sci Med*. 1998;**46**(2):243–254.
105. Möller J, Theorell T, Faire U De, Ahlbom A, Hallqvist J. Work related stressful life events and the risk of myocardial infarction. Case-control and case-crossover analyses with the Stockholm heart epidemiology programme (SHEEP). *J Epidemiol Community Health*. 2005;**59**(1):23–30.
106. Pollard TM. Changes in mental well-being, blood pressure and total cholesterol levels during workplace reorganization: The impact of uncertainty. *Work Stress*. 2001;**15**(1):14–28.
107. Vahtera J, Kivimäki M, Pentti J, et al. Organisational downsizing, sickness absence, and mortality: 10-town prospective cohort study. *BMJ*. 2004;**328**(7439):555.
108. Huczynski A, Fitzpatrick MJ. Managing employee absence for a competitive edge. Pitman; 1989.
109. Rhodes SR, Steers RM. Managing Employee Absenteeism. Reading, MA: Addison-Wesley; 1990.
110. Grinyer A, Singleton V. Sickness absence as risk-taking behaviour: A study of organisational and cultural factors in the public sector. *Health Risk Soc*. 2000;**2**(1):7–21.
111. Aronsson G, Gustafsson K, Dallner M. Sick but yet at work. An empirical study of sickness presenteeism. *J Epidemiol Community Health*. 2000;**54**(7):502–509.
112. Andreeva E, Magnusson Hanson LL, Westerlund H, Theorell T, Brenner MH. Depressive symptoms as a cause and effect of job loss in men and women: Evidence in the context of organisational downsizing from the Swedish Longitudinal Occupational Survey of Health. *BMC Public Health*. BMC Public Health; 2015;**15**(1):1–11.
113. Julian MW. The consequences of ignoring multilevel data structures in nonhierarchical covariance modeling. *Struct Equ Model*. 2001;**8**(3):325–352.
114. Rosenquist JN, Fowler JH, Christakis NA. Social network determinants of depression. *Mol Psychiatry*. Nature Publishing Group; 2011;**16**(3):273–281.

115. Bliese PD, Hanges PJ. Being both too liberal and too conservative: The perils of treating grouped data as though they were independent. *Organ Res Methods*. 2004;**7**(4):400–417.
116. Diez-Roux A. Bringing Context Back into Epidemiology: Variables and Fallacies in Multilevel Analysis. *Am J Public Health*. 1998;**88**(2):216–222.
117. Bordia P, Hunt E, Paulsen N, Tourish D, DiFonzo N. Uncertainty during organizational change: Is it all about control? *Eur J Work Organ Psychol*. 2004;**13**(3):345–365.
118. Walker HJ, Armenakis AA, Bernerth JB. Factors influencing organizational change efforts: An integrative investigation of change content, context, process and individual differences. *J Organ Chang Manag*. 2007;**20**(6):761–773.
119. Hertting A, Nilsson K, Theorell T, Larsson US. Downsizing and reorganization: Demands, challenges and ambiguity for registered nurses. *J Adv Nurs*. 2004;**45**(2):145–154.
120. Hopkins SM, Weathington BL. The relationships between justice perceptions, trust, and employee attitudes in a downsized organization. *J Psychol Interdiscip Appl*. 2006;**140**(5):477–498.
121. Armstrong-Stassen M, Cameron SJ, Mantler J, Horsburgh ME. The Impact of Hospital Amalgation on the Job Attitudes of Nurses. *Can J Adm Sci*. 2001;**18**(3):149–162.
122. Ballinger GA, Cross R, Holtom BC. The right friends in the right places: Understanding network structure as a predictor of voluntary turnover. *J Appl Psychol*. 2016;**101**(4):535–548.
123. Spreitzer GM, Mishra AK. To stay or to go: Voluntary survivor turnover following an organizational downsizing. *J Organ Behav*. 2002;**23**(6):707–729.
124. Sung W, Woehler ML, Fagan JM, Grosser TJ, Floyd TM, Labianca G (Joe). Employees' responses to an organizational merger: Intraindividual change in organizational identification, attachment, and turnover. *J Appl Psychol*. 2017;**102**(6):910–934.
125. Oshio T, Inoue A, Tsutsumi A. The Mediating and Moderating Effects of Workplace Social Capital on the Associations between Adverse Work Characteristics and Psychological Distress among Japanese Workers. *Ind Health*. 2014;**52**(4):313–323.
126. Baron RM, Kenny DA. The Moderator-Mediator Variable Distinction in Social The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *J Pers Soc Psychol*. 1986;**51**(6):1173–1182.
127. Patienthåndbogen. Sygemelding og sygedagpenge, lønmodtagere og ledige [Internet]. *Sundhed.dk* 2018 [cited 2018 Oct 9]. p. 1. Available from: https://www.sundhed.dk/borger/patienthaandbogen/sociale-ydelser/sociale-ydelser/sygedagpenge/sygemelding-og-sygedagpenge-loenmodtagere-og-ledige/
128. Marmot M, Feeney A, Shipley M, North F, Syme SL. Sickness absence as a measures of health status and functioning: from the UK Whitehall II study. *J Epidemiol Community Heal*. 1995;**49**:124–130.
129. Kivimaki M, Head J, Ferrie JE, Shipley MJ, Vahtera J, Marmot MG. Sickness absence as a global measure of health: evidence from mortality in the Whitehall II prospective cohort study. *BMJ*. 2003;**327**(7411):364.
130. Hjollund NH, Larsen FB, Andersen JH. Register-based follow-up of social benefits and other transfer payments: Accuracy and degree of completeness in a Danish interdepartmental administrative database compared with a population-based survey. *Scand J Public Health*. 2007;**35**(5):497–502.
131. Pottegård A, Schmidt SAJ, Wallach-Kildemoes H, Sørensen HT, Hallas J, Schmidt M. Data resource profile: The Danish national prescription registry. *Int J Epidemiol*. 2017;**46**(3):798.

132. Lynge E, Sandegaard JL, Rebolj M. The Danish national patient register. *Scand J Public Health*. 2011;**39**(7):30–33.
133. Helweg-Larsen K. The Danish register of causes of death. *Scand J Public Health*. 2011;**39**(7):26–29.
134. Pejtersen JH, Kristensen TS, Borg V, Bjorner JB. The second version of the Copenhagen Psychosocial Questionnaire. *Scand J Public Health*. 2010;**38**(3 Suppl):8–24.
135. Cortina JM. What Is Coefficient Alpha? An Examination of Theory and Applications. *J Appl Psychol*. 1993;**78**(1):98–104.
136. Field A. Exploratory factor analysis. In: Field A, editor. *Discov Stat Using IBM SPSS Stat*. 4th editio. SAGE Publications; 2013. p. 665–719.
137. Guyatt G, Sackett D, Sinclair J, Hayward R, Cook D, Cook R. Users' Guides to the Medical Literature. *JAMA*. 1995;**274**(22):1800–1804.
138. Grimes DA, Schulz KF. Cohort studies: marching towards outcomes. *Lancet*. 2002;**359**:341–345.
139. Lambert D. Zero-Inflated Poisson Regression, With an Application to Defects in Manufactoring. *Technometrics*. 1992;**34**(1):1–14.
140. Hubbard AE, Ahern J, Fleischer NL, et al. To GEE or not to GEE: Comparing population average and mixed models for estimating the associations between neighborhood risk factors and health. *Epidemiology*. 2010;**21**(4):467–474.
141. Brandon George. SS and IA. Survival analysis and regression models. *NIH Public Access*. 2014;**21**(4):686–694.
142. Canette I. In the spotlight: Intraclass correlations after multilevel survival models [Internet]. *Stata News* 2016 [cited 2018 Jul 31]. p. 31(2). Available from: https://www.stata.com/stata-news/news31-2/intraclass-correlations/
143. Reeuwijk KG, Wind A De, Westerman MJ, Ybema JF, Beek AJ Van Der, Geuskens GA. 'All those things together made me retire': Qualitative study on early retirement among Dutch employees. *BMC Public Health*. BMC Public Health; 2013;**13**(1):1.
144. Moore S, Grunberg L, Greenberg E. Repeated downsizing contact: The effects of similar and dissimilar layoff experiences on work and well-being outcomes. *J Occup Health Psychol*. 2004;**9**(3):247–257.
145. Ferrie JE. Labour Market Status, insecurity and health. *J Health Psychol*. 1997;**2**:373–397.
146. Johns G. Presenteeism in the workplace: A review and research agenda. *J Organ Behav*. 2010;**31**:519–542.
147. Virtanen M, Kivimäki M, Elovainio M, Vahtera J, Ferrie JE. From insecure to secure employment: Changes in work, health, health related behaviours, and sickness absence. *Occup Environ Med*. 2003;**60**(12):948–953.
148. Danmarks Statistik [Internet]. *Fuldtidsledige efter område, Pers pct, højeste fuldførte Uddann alder og køn* [cited 2018 Nov 24]. Available from: http://www.statistikbanken.dk/AUL08
149. Hausknecht JP, Hiller NJ, Vance RJ. Work-unit absenteeism: Effects of satisfaction, commitment, labor market conditions, and time. *Acad Manag J*. 2008;**51**(6):1223–1245.
150. Gopinath C, Becker TE. Communication, procedural justice, and employee attitudes: Relationships under conditions of divestiture. *J Manage*. 2000;**26**(1):63–83.
151. Morgan DE, Zeffane E. Employee inyolvement , organizational change and trust in management. *Int J Hum Resour Manag*. 2003;**14**(1):55–75.
152. Sørensen OH, Hasle P, Pejtersen JH. Trust relations in management of change. *Scand J Manag*. 2011;**27**:405–417.
153. Oksanen T, Kouvonen A, Vahtera J, Virtanen M, Kivimäki M. Prospective study of

workplace social capital and depression: Are vertical and horizontal components equally important? *J Epidemiol Community Health*. 2010;**64**(8):684–689.
154. Ferrie JE, Westerlund H, Virtanen M, Vahtera J, Kivimki M. Flexible labor markets and employee health. *Scand J Work Environ Heal Suppl*. 2008;(6):98–110.
155. Westerlund H, Theorell T, Alfredsson L. Organizational instability and cardiovascular risk factors in white-collar employees. *Eur J Public Health*. 2004;**14**(1):37–42.
156. Skakon J, Nielsen K, Borg V, Guzman J. Are leaders' well-being, behaviours and style associated with the affective well-being of their employees? A systematic review of three decades of research. *Work Stress*. 2010;**24**(2):107–139.
157. Kivimäki M, Vahtera J, Koskenvuo M, Uutela A, Pentti J. Response of hostile individuals to stressful change in their working lives: Test of a psychosocial vulnerability model. *Psychol Med*. 1998;**28**(4):903–913.
158. Fugate M, Kinicki AJ, Scheck CL. Coping with an organizational merger over four stages. *Pers Psychol*. 2002;**55**(4):905–928.
159. Mohr GB. The changing significance of different stressors after the announcement of bankruptcy: A longitudinal investigation with special emphasis on job insecurity. *J Organ Behav*. 2000;**21**(3):337–359.
160. Suttorp MM, Siegerink B, Jager KJ, Zoccali C, Dekker FW. Graphical presentation of confounding in directed acyclic graphs. *Nephrol Dial Transplant*. 2015;**30**(9):1418–1423.
161. Schyns B, Schilling J. How bad are the effects of bad leaders? A meta-analysis of destructive leadership and its outcomes. *Leadersh Q* [Internet]. Elsevier Inc.; 2013;**24**(1):138–158. Available from: http://dx.doi.org/10.1016/j.leaqua.2012.09.001
162. Semmer NK. Job stress intervention and the organization of work. *Scand J Work Environ Health*. 2006;**32**(6):515–527.
163. Allen J, Jimmieson NL, Bordia P, Irmer BE. Uncertainty during Organizational Change: Managing Perceptions through Communication. *J Chang Manag*. 2007;**7**(2):187–210.
164. Tversky A, Kahneman D. Loss Aversion in Riskless Choice: A Reference-Dependent Model Author. *Quaterly J Econ*. 2018;**106**(4):1039–1061.
165. Lederne. Rapport om virksomheders og lederes håndtering og forebyggelse af stress blandt medarbejdere [Internet]. 2017. Available from: https://www.lederne.dk/presse-og-nyheder/undersoegelser/stress-og-trivsel/stress-2017/
166. Andreeva E, Brenner MH, Theorell T, Goldberg M. Risk of psychological ill health and methods of organisational downsizing: A cross-sectional survey in four European countries. *BMC Public Health*. BMC Public Health; 2017;**17**(1):1–12.
167. Nielsen K, Taris TW, Cox T. The future of organizational interventions: Addressing the challenges of today's organizations. *Work Stress*. 2010;**24**(3):219–233.
168. Nielsen K, Miraglia M. What works for whom in which circumstances? On the need to move beyond the 'what works?' question in organizational intervention research. *Hum Relations*. 2017;**70**(1):40–62.