

## THE NOVO NETWORK: A RESEARCH AND DEVELOPMENT PLATFORM WITH THE VISION OF A NORDIC MODEL FOR SUSTAINABLE SYSTEMS IN HEALTH CARE

Jörgen Winkel, PhD; Kasper Edwards, PhD; and Rolf H. Westgaard, PhD

### Abstract

Musculoskeletal and psychological/mental disorders are major causes of sick leave, threatening the welfare of individuals and the economics of companies and societies. The prevailing research and development (R&D) of ergonomic interventions show minimal long-term effects on health and wellbeing while interventions to improve production seem to have a dominant negative effect, particularly in the health-care sector. Scientific evidence suggests that improved partnership is needed between stakeholders with different and often opposing aims, i.e., organizational productivity vs. worker wellbeing. In 2006 a Nordic R&D network, the NOVO Network, was established highlighting the need for a new approach, integrating work environment and production needs in intervention R&D. Our hypothesis is that such an integration is more readily established in the Nordic countries, largely due to their leading positions in the world in terms of social capital. Through annual symposia and other activities, the NOVO Network brings together scholars and practitioners to share knowledge and experience and to suggest and develop new areas of collaboration towards increased organizational sustainability in health care. A multicenter study conducted within the framework of the NOVO network resulted in a new, practical tool. This tool aims to facilitate partnership instead of the prevalent domination orientation, thereby combining consideration of work environment and production needs. Based on our experiences so far, this article highlights some key future challenges. As a result, we hope to see development of a stronger Nordic R&D tradition towards increased organizational sustainability in health care.

Keywords: Intervention; Sustainable Organizations; Health care; Ergonomics; Production; Work Environment; Musculoskeletal; Mental; Nordic Model; Change Processes

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## **SCIENTIFIC BACKGROUND**

Medical conditions diagnosed as musculoskeletal or as psychological/mental (hereafter mental) disorders are a major cause of sick leave, threatening the welfare of individuals and the economics of companies and societies. Swedish statistics between 2005 and 2017 show these two diagnostic categories accounting for more than 60% of certified work-related health complaints with sick leave longer than 90 days (AFA Försäkring, 2019).

During the period 2002-2010, Westgaard & Winkel (2011) scrutinized more than 10 000 scientific papers to compile the best evidence for successful ergonomic interventions in workplaces. This systematic review showed a minimal effect of ergonomic interventions, while productivity- and quality-enhancing interventions (“rationalizations”) had a dominant negative effect on health and risk factors; the most negative effects were found for downsizing and restructuring rationalizations in general and for the health-care sector in particular.

In this paper the term “rationalization” is used in accordance with the definition of the World Economic Conference (1927): “... the methods of technique and of organisation designed to secure the minimum waste of either effort or material. ...” (p. 38). “Waste” was defined by the American Engineering Council (1921) as lost production attributable to “... faulty management ...” or “... idle material, plant, equipment and men ...”, “... intentionally caused by owners, management or labour ...” and “... ill health, physical defects and accidents”(p. 8). Thus, human factors were considered at this early stage, but obviously from a rationalization point of view.

Westgaard and Winkel (2011) found an additional result to the above-mentioned negative effects of rationalizations on health and risk factors. Some studies were associated with more “sustainable production systems,” defined as the joint consideration of productivity- and quality-enhancing rationalization and working conditions (Westgaard and Winkel 2011, p. 262). A key factor in the change processes seemed to be management style or actions relating to this. Predominant positive effects were shown for worker participation in the rationalization process and in production planning, change-information to employees, organizational support and perceived fairness of the rationalization process.

A parallel may be drawn to the “partnership/dominator model” presented by Eisler (1987). According to this model, societies orient on a continuum between partnership and domination. The dominator model relies upon a top-down hierarchy that ranks individuals as superior or inferior. The same seems to occur in the health-care sector and other types of production systems. Nordic health-care organizations in particular exhibit a continuum of examples between partnership and dominator orientations (Winkel et al, 2015).

Domination would predominantly focus more on efficiency and costs than on workers’ well-being. This predominant focus highlighted the need to broaden the ergonomic intervention research from an exclusive focus on musculoskeletal and mental health to include measures to improve competitiveness and productivity toward increased sustainability of health-care organizations. An increase in the number of employees in public and private health care since the 1970s (Statistics Norway, 2020) further emphasized the need for a new research agenda on strategies to improve musculoskeletal and mental health in this sector.

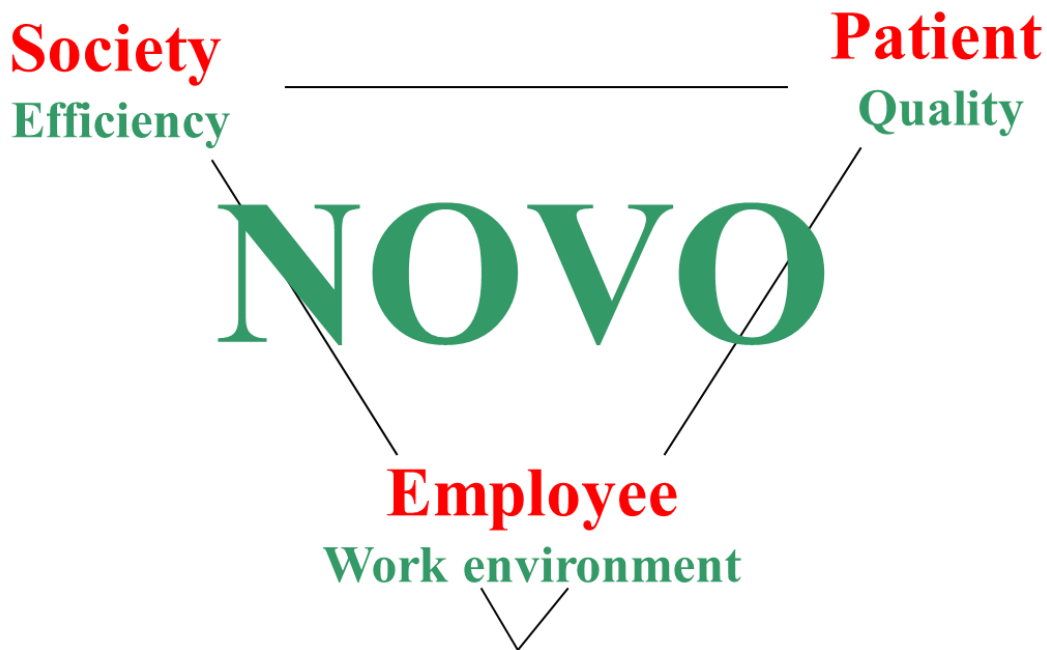
## **ESTABLISHMENT OF THE NOVO NETWORK**

In 2006, authors Westgaard and Winkel presented the preliminary strong scientific evidence for a changed focus of the intervention research to the scientific manager of

the Danish National Research Center for Work Environment (NRCWE). The authors were encouraged to organize a Scandinavian meeting at NRCWE including the scientific manager of this organization. On April 5, 2006, ten researchers participated, representing the Technical University of Denmark, the Norwegian University of Science and Technology, and the University of Gothenburg, Sweden. At this meeting it was decided to establish and develop a Nordic Research and Development (R&D) Network, thus also including Finland and Iceland. The network should highlight the combined consideration of work environment and production needs in the health-care sector. The vision should be a model for sustainable systems in the health-care sector. A sustainable system was defined as the joint consideration of competitive performance and working conditions in a long-term perspective (Westgaard & Winkel, 2011). The network should encourage and facilitate Nordic R&D co-operation along this line. The Nordic Council of Ministers approved funding of the network for a 3-year period (Nordic Council of Ministers, 2006). One of the activities should be to organize annual Nordic R&D symposia based on the above-mentioned vision.

At the first Symposium in Gothenburg, Sweden in November 2007 we presented “the NOVO triangle” (Figure 1), a visualization of our vision of a model for sustainable systems in the health-care sector. It illustrates the interdependence between Work environment, Efficiency, and Quality in intervention research and practice towards increased “organizational sustainability” in the health-care sector. The three concepts represent key needs for the employee, society, and the patient, respectively. The abbreviation “NOVO” is based on the Swedish translation of “Nordic R&D Network in Healthcare” (Nordisk FoU-nätverk inom Vård och Omsorg) due to the Scandinavian/Swedish origin of the initiative.

Figure 1: The NOVO triangle.



Since 2007 these meetings have been organized according to a rotating schedule between the 5 Nordic countries. The discussions focus on ongoing and planned R&D within the framework of the NOVO triangle (Figure 1), including challenges and opportunities to facilitate new partnerships. Non-Nordic researchers and practitioners are also welcome to participate. For further information, see <https://www.novo-network.dk/>.

## CHANGE OF ENDPOINT FROM EMPLOYEE HEALTH TO ORGANIZATIONAL SUSTAINABILITY

Most ergonomic intervention studies are designed to observe the effects of a reduction in relevant risk factors impacting the individual worker, in isolation from the potential health consequences of measures to improve performance (efficiency and quality) (Westgaard & Winkel, 2011; van der Beek et al., 2017). Therefore, a key issue for the

NOVO Network is to promote R&D considering both performance and work environment in a long-term perspective, (“organizational sustainability”, in Westgaard & Winkel, 2011), i.e. a partnership approach between all stakeholders in the organization (see below).

The kinds of R&D the NOVO Network wants to promote are case studies carried out in changing environments subject to various influences that are not always recognized (Winkel & Westgaard, 2019). Thus, they may often belong more to the social than the medical domain (Winkel & Westgaard, 2019), thereby highlighting work sociology as an additional important research field within the NOVO Network.

## **THE “NORDIC MODEL” AND NORDIC OPPORTUNITIES**

The NOVO Network is based on the concept of the Nordic Model: distinctive traditions of social responsibility and co-operation/partnership as realized in the five Nordic countries (Schiller, 1993). The Nordic Model itself regulates working-life relationships and may be described as a ‘modus vivendi’ for conflicts of interest (Guðmundsson, 1993). It aims at relationships between employer and employee at various levels, in the company as well as between the social partners (Guðmundsson 1993). In the present context, we specifically refer to negotiations with implications for the working environment, often dominated by issues related to musculoskeletal and mental disorders. The regulatory rules are partly enshrined in national labor law, partly in agreements between the social partners, and partly in non-written procedures and understandings based upon the trust between all parties (Guðmundsson, 1993). Thus, the Nordic Model, as a partnership concept, has distinct characteristics including mutual respect, two-way communication, and respect for different views.

The Nordic Model has, in the light of our special historical circumstances, gradually developed over a period of several hundred years. According to many researchers this

historical background explains the present high degree of "social capital" in the Nordic countries (Olesen et al., 2008). Social capital includes three cornerstones: teamwork, trust, and justice. Studies show that Denmark, Norway, Sweden, and Finland hold the leading positions 1-4 in the world in terms of social capital (Svendsen & Svendsen, 2006). Evidence indicates the positive impact of high social capital on both competitive performance (efficiency and quality) and work environment (Westgaard & Winkel, 2011). High social capital may have played a key role in the impressive economic growth in the Nordic countries (Olesen et al., 2008).

In Volume 6, issue 2 of this journal, Hedenigg (2019) gives a broader presentation and explanation of the Nordic Model, partly based on interviews with 20 scientists from Norway, Sweden, and Finland. Conflicts between ergonomic and production (i.e. efficiency and quality) demands are a common issue in the workplace (Winkel & Westgaard, 1996), thereby highlighting the need for further development of the partnership dimensions between the employee and employer involving senior management, operations, pre-production engineering, production engineering, human resources, health and safety, finance, production operators, and the unions. A few Scandinavian case studies have documented initiatives along these lines in industry (Kadefors et al., 1996; Neumann et al., 2006; Neumann et al., 2009) as well as in health care (Winkel et al., 2015).

Due to the apparently strong tradition of dialogue-based change processes in the Nordic countries, the NOVO Network proposes further R&D that may strengthen the vision of a Nordic Model for sustainable systems in the health-care sector.

## **THE "NORDIC MODEL" AND PARTNERSHIP STUDIES**

Comprehensive scientific evidence supports the conclusion that occupational musculoskeletal and mental disorders cannot be properly reduced by the kind of approach characterizing most ergonomic intervention research (Westgaard & Winkel,

2011; Winkel & Westgaard, 2019). We need an integrative approach that demands a new conceptual framework. This framework can be conceptualized as a partnership between actors impacting the same entity, a production system, that shall fulfil many different and to some extent contradictory requirements—societal needs, quality of output, and low costs—and contribute to the wellbeing of participants. Despite a shared responsibility for the functioning of the system, actors with specific responsibilities may not communicate well and thus cause problems for other actors.

The *Interdisciplinary Journal of Partnership Studies* presents the concept “Partnership Studies” as an emerging interdisciplinary field. It emphasizes that such studies should be “... designed to bring together scholars and practitioners to share knowledge and experience with one another, to develop new fields of inquiry, and to provide practical tools to better address our unprecedented personal, social, economic, and environmental challenges” (<https://pubs.lib.umn.edu/index.php/ijps/about>). This description aligns with the general approach of the NOVO Network, i.e. co-operation between stakeholders responsible for ergonomics and production in health-care systems. However, there are many obstacles and difficulties on the road to realization of such partnership co-operations (Winkel & Westgaard, 2019).

## **PARTNERSHIP ACTIVITIES AND EXPERIENCES WITHIN THE NOVO NETWORK**

Improvement of organizational sustainability, as outlined above, requires new partnerships in research as well as in the development of health-care production systems. An early activity of the NOVO Network was one-day focus group discussions at hospitals in the Nordic countries. In addition to researchers, participants included employees, management, and departments for operational optimization in health-care organizations. In total, almost 200 individuals participated, including 47 researchers. The meetings were organized in Sweden, Denmark, Norway, and Finland, with Icelandic representation at the meeting in Denmark. Key issues discussed included leadership in



large complex work systems, leadership that keeps the NOVO triangle together, management/employee co-operation, dissemination and implementation of new knowledge, and prognostic measures regarding organisational success and employee health.

These meetings aimed to facilitate the implementation of our subsequent first NOVO Multicenter Study: “A Nordic work environment complement to Value Stream Mapping (VSM) for sustainable patient flows at hospitals” (Winkel et al., 2012). During the years 2012-15 this study received financial support from the Nordic Council of Ministers (2012) as well as national grantors in those countries participating in the study (Sweden, Denmark, and Iceland). The project aimed at further development and scientific evaluation of ErgoVSM, a recently developed Swedish tool integrating ergonomics into an existing VSM tool in manufacturing (Jarebrant et al., 2016a) and adapting this to health-care production systems. Fourteen wards in Sweden, Denmark, and Iceland were investigated. The Multicenter Study developed a Nordic version of the ErgoVSM tool, facilitating co-operation between lean organisations, employees, and the health and safety organization in health care, aiming at increased organizational sustainability (Jarebrant et al., 2016b). This practitioner tool was designed as an add-on to commercially available lean mapping-systems, to determine physical and psychological strains of proposed productivity-enhanced changes to the work process. It thereby became a kind of “partnership tool”, by facilitating cooperation between ergonomists, employees, employers, and lean stakeholders.

In addition, a research intervention method has been developed as a “spin-off” project to our first Multicenter Study (Edwards & Winkel, 2018). This is a participative tool catalyzing dialogues between stakeholders at hospitals. It aims at increasing partnership in the development of solutions considering both performance and working conditions—situations frequently characterized by domination. The scientific part of the Multicenter Study revealed significant differences between the investigated wards

in the three countries in spite of large general cultural similarities (Winkel et al., 2015a; Winkel et al., 2015b).

In general, the NOVO Network's first Multicenter Study revealed that bringing together scholars and practitioners from the different partners at hospitals resulted in an abundance of suggestions aimed at improving both work environment and production. Through constructive dialogues between the partners, they were able to handle interventions that were aimed at improved production, but that had a negative impact on work environment. The success of such dialogues appeared to be facilitated when management emphasized involvement and decision-making among the participants, by allocation of sufficient resources and by first-line manager support and engagement. This suggest that "partnership" is not just working together but also the way you work together with respect and mutuality.

The investigated generation of new solutions for increased organizational sustainability in hospital wards contrasts with the general procedure in the vast majority of ergonomic interventions research as detailed by van der Beek et al. (2017). The latter is rooted in the medical research tradition, with a primary focus on risk factors, underlying pathophysiological mechanisms, and randomized controlled trial research design, rather than including consideration of production needs towards increased organizational sustainability. As the prevailing research tradition does not include other partners, this may strongly contribute to the lack of long-term improvement of the work environment (Westgaard & Winkel, 2011; Winkel & Westgaard, 2019).

## **FUTURE RESEARCH AND DEVELOPMENT CHALLENGES**

It is assumed that partnership between social partners with a high level of social capital (as in the Nordic Model) will also impact the level of partnership at the associated workplaces. Such relationships constitute an interesting R&D topic, although the NOVO

Network primarily focuses on partnership issues at the workplace level, and in health care only. A key question is, How do we improve the social capital (i.e. teamwork, trust and justice) between relevant stakeholders in an organization?

More specifically, we need a better understanding of the mechanisms that take place at the workplace level, in particular aspects of the dialogue process. What are critical prerequisites for a positive environment for dialogues? Scientific methods need to be developed to support this line of inquiry. And, how can such insight be measured and made available in a meaningful (applicable) way to the health-care organizations?

In practical terms, this will necessitate an expanded research protocol that includes recording of experiences when establishing intervention projects, such as company culture, including dialogue between stakeholders with conflicting primary aims. This knowledge will hopefully be of interest to both researchers and practitioners outside the Nordic countries and in other worklife sectors.

### **Acknowledgement**

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### **References**

AFA Försäkring. (2019). *Allvarliga arbetsskador och långvarig sjukfrånvaro* [English title: *Serious work injuries and long-term sick leave*]

[https://www.afaforsakring.se/globalassets/forebyggande/analys-och-statistik/rapporter/2019/f7060\\_arbetsskaderapport\\_2019.pdf](https://www.afaforsakring.se/globalassets/forebyggande/analys-och-statistik/rapporter/2019/f7060_arbetsskaderapport_2019.pdf)

American Engineering Council. (1921). *Waste in industry*. McGraw-Hill.

Edwards, K. & Winkel, J. (2018). A method for Effect Modifier Assessment (EMA) in ergonomic intervention research. *Applied Ergonomics*, 72, 113-120.

<https://doi.org/10.1016/j.apergo.2018.05.007>

- Eisler, R. (1987). *The chalice and the blade: Our history, our future*. ISBN 0-06-250287-5, 304 pp. HarperSanFrancisco
- Grant, A.M. & Wall, T.D. (2009). The neglected science and art of quasi-experimentation: Why-to, when-to, and how-to advice for organizational researchers. *Organizational Research Methods*, 12(4) <https://doi.org/10.1177/1094428108320737>
- Guðmundsson, G. (1993). *Den nordiske model - en afklaring av begreber. Nordisk Seminar- og Arbejdsrapport*. [English title: *The Nordic model - a clarification of concepts. Nordic Seminar and Work Report*]. ISBN 92-9120-392-0
- Hedenigg, S. (2019). Caring economics and the Nordic Model. *Interdisciplinary Journal of Partnership Studies*, 6(2), 2. <https://doi.org/10.24926/ijps.v6i2.2086>
- Jarebrant, C., Winkel, J., Johansson Hanse J., Mathiassen, S.E., & Öjmertz B. (2016a). ErgoVSM: A tool for integrating value stream mapping and ergonomics in manufacturing. *Human Factors and Ergonomics in Manufacturing & Service Industries* 26(2), 191-204. <https://doi.org/10.1002/hfm.20622>
- Jarebrant, C., Johansson Hanse, J., Ulin, K., Winkel, J., Edwards, K., Birgisdóttir, B.D., & Gunnarsdóttir, S. (2016b). *Ergonomic Value Stream Mapping (ErgoVSM): Tool and user guide*. Nordic Council of Ministers, ISBN 978-92-893-4572-9 (PRINT), ISBN 978-92-893-4573-6 (PDF)
- Kadefors, R., Engström, T., Petzäl, J., & Sundström, L. (1996). Ergonomics in parallelized car assembly: A case study, with reference also to productivity aspects. *Applied Ergonomics* 27(2), 101-110. [https://doi.org/10.1016/0003-6870\(95\)00064-x](https://doi.org/10.1016/0003-6870(95)00064-x)
- Neumann, W.P., Ekman, M., & Winkel, J. (2009). Integrating ergonomics into production system development - The Volvo powertrain case. *Applied Ergonomics*, 40(3), 527-537. <https://doi.org/10.1016/j.apergo.2008.09.010>.
- Neumann, W.P., Winkel, J., Medbo, L., Magneberg, R., & Mathiassen S.E. (2006). Production system design elements influencing productivity and ergonomics - A case study of parallel and serial flow strategies. *International Journal of Operations and Production Management*, 26(8), 904-923. <https://doi.org/10.1108/01443570610678666>.
- Olesen, K.G., Thoft, E., Hasle, P., & Kristensen, T.S. (2008). *Virksomhedens sociale kapital. Hvidbog*. [English title: *The company's social capital. White Paper*]. Det nationale forskningscenter for arbejdsmiljø. ISBN: 978-87-7904-190-5
- Nordic Council of Ministers. (2006). Research Application: "NORDIC R&D NETWORK IN THE HEALTH CARE SECTOR: The work environment in increasingly effective organisations" (# 70106)
- Nordic Council of Ministers. (2012). Research Application: "A Nordic work environment complement to Value Stream Mapping (VSM) for sustainable patient flows at hospitals - A NOVO Multicenter study" (# 11347)

- Schiller, B. (1993). *The future of the Nordic Model of labour relations*. ISBN 92.9120 3688, ISSN 0903-7004
- Statistics Norway. (2020). *Befolkningens tilknytning til arbeidsmarkedet*. [English title: *The population's connection to the labor market*] <https://www.ssb.no/arbeid-og-lonn/faktaside/arbeid>
- Svendsen, G.T., & Svendsen, G.L.H. (2006). *Social kapital. En introduktion*. [English title: *Social capital. An introduction*]. Hans Reitzel Forlag. ISBN: 9788741250175
- van der Beek, A.J., Dennerlein, J.T., Huysmans, M.A., Mathiassen, S.E., Burdorf, A., van Mechelen, W., van Dieën, J.H., Frings-Dresen, M.H.W., Holtermann, A., Janwantanakul, P., van der Molen, H.F., Rempel, D., Straker, L., Walker-Bone, K., & Coenen, P. (2017). A research framework for the development and implementation of interventions preventing work-related musculoskeletal disorders. *Scandinavian Journal of Work, Environment & Health*, 43(6), 526-39. <https://doi.org/10.5271/sjweh.3671>
- Westgaard, R.H. & Winkel, J. (2009). Occupational musculoskeletal and mental health: Significance of rationalization and opportunities to create sustainable production systems in health care - a systematic review. 3rd NOVO Symposium, Copenhagen, Denmark. Abstract Book, pp 33-37,. ISBN: 978-87-7904-207-0
- Westgaard, R.H. & Winkel, J. (2011). Occupational musculoskeletal and mental health: Significance of rationalization and opportunities to create sustainable production systems - a systematic review. *Applied Ergonomics*, 42(2), 261-296. <https://doi.org/10.1016/j.apergo.2010.07.002>
- Winkel, J., Birgisdóttir, B.D., Dudas, K., Edwards, K., Gunnarsdóttir, S., Jarebrant, C., & Johansson Hanse, J. (2012). A Nordic work environment complement to Value Stream Mapping (VSM) for sustainable patient flows at hospitals - A NOVO Multicenter study. 6th NOVO Symposium: Sustainable Health Care: Continuous Improvement of Processes and Systems. Karolinska Institute, Stockholm Sweden. November 15-16, pp 57-58. ISBN: 978-91-637-2380-3
- Winkel, J., Edwards, K., Birgisdóttir, B.D., & Gunnarsdóttir, S. (2015a). Facilitating and inhibiting factors in change processes based on the lean tool 'value stream mapping': An exploratory case study at hospital wards. *International Journal of Human Factors and Ergonomics*, 3(3/4) 291-302. <https://doi.org/10.1504/ijhfe.2015.073000>
- Winkel, J., Edwards, K., Birgisdóttir, B.D., Jarebrant, C., Johansson Hanse, J., Gunnarsdóttir, S., Harlin, U., & Ulin, K.. (2015b). A Nordic evaluation of a work environment complement to Value Stream Mapping for increased sustainability of patient flows at hospitals - The NOVO Multicentre Study I. In: André, B., Heldal, F., Edwards, K. (Eds.) Abstract book, The 9th Novo symposium: Quality in Health Care, Trondheim, November 12 - 1, pp 33-35. <https://doi.org/10.11581/DTU:00000012>
- Winkel J., & Westgaard R.H. (1996). A model for solving work related musculoskeletal problems in a profitable way. *Applied Ergonomics*, 27(2), 71-77. [https://doi.org/10.1016/0003-6870\(95\)00061-5](https://doi.org/10.1016/0003-6870(95)00061-5)

Winkel, J. & Westgaard, R.H. (2019). Development and implementation of interventions managing work-related musculoskeletal disorders: Inadequacy of prevalent research framework and future opportunities. *Scandinavian Journal of Work, Environment and Health*, 45(3) 316-317. <https://doi.org/10.5271/sjweh.3815>

World Economic Conference. (1927). *World Economic Conference in Geneva. Final Report. League of Nations*, Geneva, pp. 1-76

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