Title: What is the impact of self-scheduling on the patient, employee and organisation? A systematic review.

Abstract (working paper)

Aims: To evaluate the current evidence base and provide a systematic overview of this evidence on the relationship between self-scheduling and patient, employee- and organisation-related outcomes.

Background: The ongoing shortage of qualified nursing staff together with the detrimental effects of shift work have resulted in a search for the perfect schedule for healthcare personnel. Self-scheduling is one method to enhance flexibility and give more control to the employee. At first sight, self-scheduling appears to be successful in some organisations and not in others. This inconsistency is confusing for policymakers and prevents further implementation of self-scheduling in practice.

Evaluation: Twenty three studies were identified, and subdivided into exploratory and descriptive studies because of their distinct features. Following outcomes were analysed: patient- and employee-reported quality of care, job satisfaction, satisfaction with scheduling, work/life balance, planning involvement, interaction with colleagues, health and well-being, psychosocial factors, professional development, nurse manager's time on scheduling, general working conditions, turnover, agency utilization and absenteeism, recruitment and retention.

Conclusion: Several studies confirmed that self-scheduling can have a positive impact (e.g. on work/life balance). However, negative impact on certain outcomes, opposite results or no statistically significant results have also been revealed. The evidence base is too thin and insufficient to make strong statements. Future research should use multimethod longitudinal studies, include patient-centred outcomes and employ a theoretical framework that gives attention to the concept of fairness or justice.

Implications for management: The implementation and sustainability of the self-scheduling system is a major challenge for healthcare management. This review summarizes practical tips for a successful implementation in order that future policy can be adjusted according to lessons learned in the past.

Keywords healthcare, self-scheduling, implementation, outcome

Title: What is the impact of self-scheduling on the patient, employee and organisation?

A systematic review.

INTRODUCTION

A long history of experiencing shortages of nursing staff and the related struggles with retaining personnel has led healthcare organisations to pursue the perfect balance between patients' needs and the right number of nursing staff (Kieft, de Brouwer et al. 2014). This is a precarious exercise given the 24-hour a day, seven days a week coverage, the variability in patient volume patterns, the individual staff preferences and other conflicting aspects of nurse rostering (Tarpey and Nelson 2009). The resulting complex nurse scheduling problem has been studied for decades in the field of operation research where they strive to assign an ideal number of nurses for each shift, while respecting both the preferences of the nurses and the objectives of the healthcare organisation, within the framework of government regulations (Bagheri, Devin et al. 2016). Despite many years of research, there still remains a gap between the mathematical models and the flexibility that is needed to address the real life nurse scheduling problems (Burke, De Causmaecker et al. 2004). In addition, offering flexible work arrangements is viewed as a big advantage and considered one of the critical aspects for nurse job satisfaction and retention (Eby, Casper et al. 2005, Storey, Cheater et al. 2009, Koning 2014). Furthermore, schedule flexibility - when the staff has some to full control over their working hours - has been shown to moderate the negative effect of shift work on work–life balance, vitality, mental health and stress symptoms (Albertsen, Rafnsdóttir et al. 2008). One example to enhance flexibility and work time control is self-scheduling.

Self-scheduling or self-rostering moves the responsibility of creating a work schedule to the employees, giving them more control over their work hours (Asgeirsson 2014). This concept was documented for the first time in 1963 by Jenkinson who implemented self-scheduling at a hospital in London (Hung 2002). Over the years, different strategies for self-scheduling have been executed and this with varying levels of control the employees had over their working time (Pryce, Albertsen et al. 2006, Bailyn, Collins et al. 2007). In general, the process is structured in a number of steps, repeated every scheduling period and can be performed manually or via IT-supported systems (Teahan 1998, Ingre, Åkerstedt et al. 2012, Albertsen, Garde et al. 2014). Frist, every employee can request a schedule for him or herself given pre-established scheduling rules. In this phase, entered schedules of the other personnel are not visible, which makes it possible to only consider his or her own preferences. Next, all the

submitted schedules are concatenated making it clear for which shifts there are shortages or excesses. This is the core stage of the self-scheduling process, where nurses (or nursing assistants) negotiate with each other to trade shifts in order to meet the staffing needs. For the remaining adjustments or if no consensus can be reached anymore, a scheduling committee sometimes exist (consisting of different employees according to a rotation system) to make the final adjustments. At last, the final draft has to be approved by the head nurse, who becomes a facilitator rather than a controller during this entire process (Ronnberg and Larsson 2010).

Self-scheduling has already been instituted in many healthcare organisations in an attempt to improve flexibility, increase job satisfaction and facilitate professional growth for nurses (De Grano, Medeiros et al. 2009, Koning 2014). It is one way management attempts to empower their staff to plan their own schedule, giving them more autonomy and more control over their work-life balance (Bailyn, Collins et al. 2007). However, previous research shows that a subdivision can be made between possible advantages and disadvantages of self-scheduling. Research that advocates self-scheduling noted several potential benefits for the employee, for example an increase of job satisfaction leading to enhanced involvement and commitment (Rondeau and Wagar 2016), minimisation of the negative impacts of shift work (Brooks 2000) and better fit between work and personal or family situations (Rondeau and Wagar 2016). For the organisation, self-scheduling can improve recruitment and commitment (Griesmer 1993, Bluett 2008), decrease absenteeism (Miller 1992) and turnover rates when nurses feel they have control over their practice (Hayes, O'Brien-Pallas et al. 2006, Pryce, Albertsen et al. 2006). Furthermore, a reduction in time spent on producing the (off-duty) roster by the head nurse is often mentioned (Miller 1984, Bischof 1992, Tully 1992). Finally, possible benefits for the patient have also been mentioned, however not specified (Bailyn, Collins et al. 2007).

Although the approach of self-scheduling is appealing, not everyone is equally enthusiastic. First, the implementation process can be challenging in practice from an operational and optimisation point of view (Ronnberg and Larsson 2010). Second, it can be time-consuming (De Grano, Medeiros et al. 2009) and impractical to hold meetings to resolve conflicts (Griesmer 1993), especially for medium to large units (Silvestro and Silvestro 2000). Third, nurses with better negotiation skills tend to obtain the more attractive shifts (Ronnberg and Larsson 2010) and when no formal procedures for conflict resolving exist, it can be difficult to guarantee fairness (De Grano, Medeiros et al. 2009). Furthermore, the process can easily lead to overstaffing or understaffing when there is an inability to match the nurses' preference with the staffing requirements (Bailyn, Collins et al. 2007). Finally, it can have a negative impact on the continuity to patients and colleagues (Nabe-Nielsen, Garde et al. 2012).

At first sight, self-scheduling appears to be successful in some organisations and not in others. This inconsistency is confusing for policymakers and prevents further implementation of self-scheduling in practice. Hence, the need for a systematic review on this topic. To the best of our knowledge, no previous study has systematically explored the relationship between self-scheduling for nurses or nursing assistants and a wide range of outcomes. The current systematic review aims to assess and to summarize the current evidence on the relationship between self-scheduling and patient, employee- and organisation-related outcomes.

MATERIALS AND METHODS

Search strategy and study selection

This is a systematic review of the scientific literature published before October 2019 (week 40) which assessed and summarized the current evidence on the relationship between self-scheduling and patient, employee- and organisation-related outcomes. The Pubmed, Embase, Web of Science, Cinahl, Scopus, Google Scholar and the ERIC databases, along with the Cochrane Library, were searched for relevant studies. The initial search strategy was validated using a selection of key papers known to the authors. While reviewing these studies, we noted somewhat heterogeneity in terms of terminology and criteria employed, for example, between flexible rostering and self-scheduling. In order to ensure review of studies using various definitions of "self-scheduling", we assessed studies that defined self-scheduling as a working time arrangement where the staff is fully responsible for making a schedule within the restrictions of the organisation (often with the help of computerized IT software). Next, we identified potential "MeSH terms" via Pubmed and added non-MeSH entry terms and synonyms meeting the inclusion criteria to complete the search string. Table 1 gives an overview of the inclusion and exclusion criteria that were determined a priori.

(insert) Table 1: Inclusion and exclusion criteria

Screening

The selection of studies was conducted based on a two-step procedure. First, duplicates were removed and two reviewers (H.W. and E.P.) independently filtered by title and abstract. In case of non-matching results, a third reviewer (J.T.) was consulted to reach a consensus. The remaining articles were selected for full-text retrieval and underwent a critical quality appraisal. In addition, we screened the reference lists of all the publications and applied a forward and backward citation track.

Quality appraisal

Following Fabienne Reiners et al. (Reiners, Sturm et al. 2019) we used the Mixed Methods Appraisal Tool or MMAT (Hong QN Version 2018) to evaluate the methodological quality of the included papers. This instrument is a revised version of two earlier editions of the MMAT developed in 2006 and 2011 (Pluye, Gagnon et al. 2009, Pace, Pluye et al. 2012). This instrument has been verified to be a reliable and valid tool for assessing quality of studies with diverse designs. Part of the quality appraisal was conducted by two reviewers (H.W. and E.P.). Disagreement between the two raters was solved via a consensus discussion. When no consensus could be reached, a third reviewer (J.T.) was consulted.

RESULTS

Results of the search strategy

The initial database searches resulted in a total of 2,349 studies. After adjusting for duplicates, 1,998 articles remained. Subsequently, screening on title and abstract was completed and 1,948 articles were excluded because they did not meet the predefined inclusion criteria. After reading the full text, 22 studies remained eligible for inclusion. In addition, one additional article was included via forward and backward citation track. A diagram of the data extraction process is presented in figure 1.

(insert) Figure 1: Flowchart of data extraction process

Study characteristics

All studies were published between 1984 and 2017. The articles originated in Europe (48%), North America (35%) or the United Kingdom (17%). According to the quality appraisal, the quantitative non-randomized studies and the mixed method studies had an overall stronger study design when compared to the qualitative and quantitative descriptive studies. As regards the qualitative and quantitative descriptive studies, due to the lack of details about the methodology being used, it was often impossible to retrieve the necessary information to answer every question. The quality appraisal of these 23 articles is listed in Table 2.

(insert) Table 2: Quality appraisal

It is to be noted that there are two groups that differ substantially from each other in view of the disparity in their quality appraisal and study characteristics. For this reason, a distinction will be made in this review between *exploratory research*, including both quantitative non-

randomized studies and mixed methods studies (n=9) and *descriptive research*, including quantitative descriptive studies and qualitative studies (n=14).

The studies in the first group (n=9), the exploratory research, were published between 2006 and 2016 and originated 100% from Europe (Denmark or Sweden). Seven studies used a computerised self-scheduling method (two studies did not specify the method). With the exception of one study, all designs were longitudinal with samples drawn from the hospital sector (67%) or the elderly care setting (33%). These samples included in 67% of the studies more than one hospital or organisation. In addition, linear mixed model and generalized linear model (GEE method) were the most frequently used statistical methodologies (56%). The presence of adjustments for confounding factors varied across the included studies. Most frequently used nurse characteristics were age, gender and family type. In contrast, job status (part-time versus full-time) and the roles taken by the healthcare professionals were seldom taken into account. Apart from that, not a single study accounted for organisational characteristics. Furthermore, only one study gave details about the included nursing units and related ward size. Finally, multiple staff- and organisation-related outcome measures were explored but only one study looked into patient outcomes.

In the second group (n=14), the descriptive research, studies were published between 1984 and 2017 (of which 86% before 2005). The majority of the research was carried out in the USA (57%) and used a manual self-scheduling method (85%). All studies but one used samples drawn from the hospital sector. The greater part of the studies only included one ward in one hospital (64%), while 14% included multiple wards in one organisation and 22% included more than one hospital. Eight of the twelve studies (67%) that revealed information about the ward type included at least one intensive care unit in their sample. In addition, ward sizes ranged from 6 beds on an intensive care unit to 62 beds on a medical unit. Finally, these studies only explored multiple staff- and organisation-related outcomes.

The characteristics of these 23 studies and the results per outcome are listed in Table 3 and Table 4.

(insert) Table 3: Study characteristics

(insert) Table 4: Results per outcome

The next section provides an overview of the findings per outcome for the 23 included articles. Since the reported outcomes are very diverse, they are compiled in a number of subgroups.

Patient outcomes

Only one article studied patient outcomes (Kullberg, Bergenmar et al. 2016), i.e. patient-reported quality of care. This study implemented fixed scheduling (the intervention) and compared the results with self-scheduling (control). No statistically significant differences were found between the two groups. The author concluded that the type of scheduling did not affect patient-reported outcomes.

Staff-related outcomes

Job satisfaction

Two studies described job dissatisfaction (Pryce, Albertsen et al. 2006, Hansen, Nabe-Nielsen et al. 2015), however with opposite results. The implementation of self-scheduling could be an effective intervention to improve job satisfaction according to Pryce et al. (2006), while job satisfaction decreased or no significant results could be found in the study of Hansen et al. (2015).

Satisfaction with scheduling

Our review identified five articles addressing satisfaction with scheduling as an outcome. Garde et al. (2012) found that one intervention, where preferences for starting time and length of shift could be specified, increased satisfaction with working hours. In addition, Ingre et al. (2012), found that self-rostering was associated with personal fit with respect to night, evening and morning work. Three descriptive studies (Hawkins and Sutton 1991, McCoy 1992, Richmond 2003) all supported this result, stating that staff was satisfied with the self-scheduling system.

Work/life balance

Work/life balance was reported by three exploratory studies (Pryce, Albertsen et al. 2006, Nabe-Nielsen, Garde et al. 2011, Albertsen, Garde et al. 2014) and three descriptive studies (Ball 1997, Wortley and Grierson-Hill 2003, Bailyn, Collins et al. 2007). The first group of studies did either find a significant effect on the experience of work/life balance or attributed the lack of significance to a limited sample size. The descriptive studies nearly all confirmed this result, with the exception of one ward in the study of Ball (1997) where the staff was generally more satisfied with their previous method.

Planning involvement

Involvement in planning was addressed by eleven studies. Three exploratory studies described the same study project (Garde, Nabe-Nielsen et al. 2011, Nabe-Nielsen, Garde et al. 2011, Nabe-Nielsen, Garde et al. 2012) and another two exploratory studies were part of another larger project (Garde, Albertsen et al. 2012, Hansen, Nabe-Nielsen et al. 2015). They all concluded that implementing self-scheduling can increase work-time influence. The decrease in the frequency of being asked to come to work at short notice could not solely be ascribed to the implementation of self-scheduling (Nabe-Nielsen, Garde et al. 2012). This contrasts the results of Kullberg et al. (2016) which found that staff that implemented *fixed* scheduling were less often asked to change shifts at short notice compared to the self-scheduling wards. The remaining five descriptive studies cited control and flexibility as benefits (Hawkins and Sutton 1991, Hensinger, Harkins et al. 1993, Richmond 2003, Bailyn, Collins et al. 2007), though the demand for certain days off could not always be met (Hawkins and Sutton 1991, Teahan 1998).

Interaction with colleagues

The interaction with colleagues emerged as a frequently studied topic. Four out of five exploratory studies found a significant difference in social support from colleagues between pre- and post- implementation of a new scheduling method. Three of them found an increase in social support when implementing self-scheduling (Pryce, Albertsen et al. 2006, Nabe-Nielsen, Garde et al. 2011, Hansen, Nabe-Nielsen et al. 2015). The fourth study implemented *fixed* scheduling and reported that the significant difference at follow-up was due to a decrease of team spirit in the self-scheduling (control) group (Kullberg, Bergenmar et al. 2016). In addition, Ingre et al. (2012) found that conflicts at the workplace about work hours and the perceived need to know one's co-workers well was associated with preference for a fixed schedule. Seven descriptive studies all described that the implementation of self-scheduling had enhanced collegial relationships amongst the staff (Miller 1984, Hawkins and Sutton 1991, Miller 1992, Abbott 1995, Ball 1997, Teahan 1998, Silvestro and Silvestro 2000). Nevertheless, change management should be taken into account, e.g. negotiation skills need to be trained (Abbott 1995, Teahan 1998).

Health and well-being

Health and well-being was studied in four exploratory studies. Three of them could not find any significant benefit to health or well-being (Pryce, Albertsen et al. 2006, Garde, Nabe-Nielsen et al. 2011, Nabe-Nielsen, Garde et al. 2011). The fourth study, Garde et al. (2012), concluded

that self-scheduling was associated with less need for recovery and improved health. The latter was applicable for the intervention group where employees only could determine the number of predefined shifts (Garde, Albertsen et al. 2012).

Psychosocial factors

Psychosocial factors were reported by seven studies and all the results were descriptive in nature. Three studies reported an increase in staff's perception of autonomy and empowerment since the introduction of self-scheduling (Miller 1984, Teahan 1998, Wright, McCartt et al. 2017), although, according to Pryce et al. (2006), some employees also felt insecure and uncomfortable with the increased responsibility linked to self-scheduling. In addition, while Vetter at al. (2001) found that self-scheduling was perceived as fair and equitable by the staff, a study by Silvestro et al. (2000) showed a perceived inequity between employees because the junior staff were given considerably less discretion over shift allocations than senior staff nurses. Finally, one study suggests that the self-scheduling system increased justice in the work schedule (Albertsen, Garde et al. 2014).

Quality of care

Employee-reported quality of care was studied in five studies. Kullberg et al. (2016) found no significant differences between the intervention (self-scheduling) and control wards with regard to how the staff rated patient continuity. On the other hand, three descriptive studies argued that the perceived quality of patient care has improved (Hawkins and Sutton 1991, Miller 1992, Bailyn, Collins et al. 2007). Finally, Nabe-Nielsen et al. (2012) claimed that due to individualised work schedules, the staff now had to co-operate with more colleagues during a working week and taking good care of patients was easier when working together with colleagues that know each other well.

Organisation-related outcomes

Professional development

Our review identified seven articles addressing professional development as an outcome, including only descriptive results. Five studies identified an increased awareness by the employees into how the department operated (Miller 1984, Teahan 1998, Richmond 2003, Pryce, Albertsen et al. 2006, Wright, McCartt et al. 2017). Two studies reported no impact on professional growth (Miller 1992, Hensinger, Harkins et al. 1993), although the manager did document a change in this area in the study of Miller et al. (1992).

General working conditions

General working conditions were addressed by two exploratory and two descriptive studies. Silvestro et al. (2000) concluded that designing a well-balanced roster becomes more difficult as ward size increases. When many individuals are involved in the planning process, the global view of the roster can be lost. Therefore, self-rostering works most effectively in small wards which have a simple rostering problem (Silvestro and Silvestro 2000). In addition, Kullberg et al. (2016) showed that the general working conditions decreased for self-scheduling group (control group), Hansen et al. (2015) found that self-scheduling was associated with a decrease in social support from supervisors and Abbott et al. (1995) noted that nurse manager is less involved in the negotiations of shift changes.

Nurse manager's time on scheduling

Nurse manager's time on scheduling was reported by six descriptive studies. All of them described a decrease in time the nurse manager spent to make the monthly schedule (Miller 1984, Abbott 1995, Teahan 1998, Vetter, Felice et al. 2001, Richmond 2003, Bailyn, Collins et al. 2007).

Turnover

Six studies described turnover, of which the only exploratory study could not identify any differences or trends in turnover (Kullberg, Bergenmar et al. 2016). The remaining five descriptive studies (Miller 1984, Hawkins and Sutton 1991, Miller 1992, Teahan 1998, Wright, McCartt et al. 2017) all reported a decrease in turnover, except for two out of four wards in the study of Wright et al. (2017).

Agency utilization and absenteeism

Our review identified six articles examining agency utilization or absenteeism. One exploratory study (Kullberg, Bergenmar et al. 2016) found no differences or trends in short-term sick leave, while three descriptive studies did report a reduction in sick calls or absenteeism (Miller 1992, Teahan 1998, Bailyn, Collins et al. 2007). Apart from that, the use of agency personnel also decreased (Hawkins and Sutton 1991, Miller 1992).

Recruitment and retention

Four studies reported that self-scheduling made the nursing ward a more attractive place to work and was an effective tool in recruitment and retention (Hawkins and Sutton 1991, Hensinger, Harkins et al. 1993, Silvestro and Silvestro 2000, Albertsen, Garde et al. 2014).

DISCUSSION

This paper provides an overview of the literature that examined the relationship between self-scheduling and patient, employee- and organisation-related outcomes. The results of this review, subdivided into one patient outcome, eight staff-related outcomes and six organisation-related outcomes show some important findings.

First of all, the exploratory studies found statistically significant results for an increased satisfaction with scheduling, an increased work-time influence and positive effects on work/life balance, yet also a decrease in general working conditions (including a decrease in social support from supervisors). No statistically significant results were found for patient- or staff-reported quality of care, health and well-being (except for one study), turnover and short-term sick leave. In addition, opposing results were found for job satisfaction and social support from colleagues. Most of the descriptive studies confirmed these results, with the exception of staff-reported quality of care (improved), turnover (decreased) and sick calls or absenteeism (decreased). In addition, they also noted a decrease in nurse managers time and positive results were reported for psychosocial factors, professional development, recruitment and retention.

Second, the implementation of self-scheduling was often not without difficulties (Ball 1997, Richmond 2003, Wortley and Grierson-Hill 2003, Bailyn, Collins et al. 2007) and the process was described and evaluated by the authors using various components and techniques. The exploratory studies mainly used a combination of qualitative and quantitative methodologies to describe the implementation process. The qualitative component is essential because it provides insight into, inter alia, the acceptability of the intervention, the barriers to participation and the social consequences (Pope and Mays 1995). This mixture of methods is also recommended by the Medical Research Council's Framework (MRC), a framework that was published in response to the difficulties when developing complex interventions and to evaluate their impact (Campbell, Fitzpatrick et al. 2000, Craig, Dieppe et al. 2008). Furthermore, the MRC guidance also recommends that the intervention design should rely on a theoretical understanding of how an intervention causes change (Campbell, Fitzpatrick et al. 2000, Craig, Dieppe et al. 2008).

This theory could be of value in determining which features of an intervention are probably important in influencing outcomes and sustainability (Datta and Petticrew 2013). In light of this, self-scheduling has already been linked to total quality management (TQM), where the manager is a facilitator rather than a supervisor, and thus empowering their staff to increase process ownership, motivation and commitment (Silvestro and Silvestro 2000). Moreover, it appears that the success of complex interventions is likely to depend on the context in which they are implemented (Van Herck, Vanhaecht et al. 2010). A framework has already been developed that determines the choice of rostering approach for a nursing ward on the basis of four contingent variables, that is ward size, demand variability, demand predictability and complexity of skill mix (Silvestro and Silvestro 2000). Self-rostering seems to be appropriate in small wards with relatively straightforward rostering problems. (Silvestro and Silvestro 2000).

Third, a rough subdivision can be observed between the exploratory and descriptive studies. The first group mainly used a computerised self-scheduling method, achieved a higher quality score and were published more recently. All of the studies used a longitudinal design, with the exception of Ingre et al. (2012) using a cross-sectional design. These longitudinal studies all used non-randomization, except for two studies using randomization or a mix of both (Pryce, Albertsen et al. 2006, Nabe-Nielsen, Garde et al. 2011). The advantage of randomization is that an even distribution of unknown potential confounders can be expected, however the number of randomized units need to be large (Rothman 1998). On the other hand, group differences indicate a potential risk of bias due to unmeasured confounding when the wards were not randomised to an intervention or control group (Albertsen, Garde et al. 2014). The descriptive studies mostly used manual self-scheduling systems, achieved a lower quality score and were older. These studies often described the implementation of self-scheduling on one (often their own) ward.

Fourth, most studies applied a study duration of twelve months after which an evaluation took place. Given the various outcomes that are measured in the studies, it appears that there is a difficulty in deciding upon which outcomes to focus on when assessing self-scheduling. Restricting to one single outcome leads to numerous unsolved questions about the enabling and disabling factors for the effectiveness of the intervention (de Vlaming, Haveman-Nies et al. 2010). The multiplicity of health and non-health outcomes increases the complexity of the evaluation (Datta and Petticrew 2013). In addition, a long-term follow-up entails potential methodological risks, for example, an inflation of type I error by capitalizing on chance

findings, selection bias and differential attrition leading to artificial group differences over time (Hill, Woodward et al. 2016) could emerge. Furthermore, the fact that no significant results were found for e.g. health and turnover, is possibly due to other factors that might mediate both the implementation process and the outcome (Hayes, Bonner et al. 2010).

Fifth, almost all the patient and staff-related outcomes were measured by self-reported surveys which may be prone to response and recall bias. Furthermore, the outcomes based on nurses' perception are open to the subjective experiences and measurements (of working hours) could be insufficiently sensitive (e.g. when no distinguish is made between working on a Monday versus a Wednesday (Garde, Albertsen et al. 2012). Despite these disadvantages, self-reports have considerable predictive validity and can focus explicitly on staffing at the patient bedside (Aiken, Clarke et al. 2002, Aiken, Clarke et al. 2008, Aiken, Sloane et al. 2010).

Limitations

Our systematic review shows that results of previous studies are mixed and inconclusive. The findings show a subdivision between two types of studies (exploratory and descriptive studies). When we look at the exploratory studies, an often mentioned limitation is the lack of power due to the limited sample size (Garde, Nabe-Nielsen et al. 2011, Nabe-Nielsen, Garde et al. 2011). In addition, non-randomization of the included wards results in large differences between the interventions, making it difficult to compare them. Furthermore, inclusion criteria could have influenced the generalizability of the results as it is likely that the workplaces that volunteered to participate in the studies were not representative of the healthcare sector in general (Nabe-Nielsen, Garde et al. 2012, Hansen, Nabe-Nielsen et al. 2015). Also, given that multiple studies also include non-healthcare settings (Garde, Albertsen et al. 2012, Ingre, Åkerstedt et al. 2012, Albertsen, Garde et al. 2014, Hansen, Nabe-Nielsen et al. 2015), some of the fine details typical to the healthcare sector are lost (e.g. no specification of the functions). Furthermore, two groups of three studies were performed by the same research group (Garde, Nabe-Nielsen et al. 2011, Nabe-Nielsen, Garde et al. 2011, Nabe-Nielsen, Garde et al. 2012) and (Garde, Albertsen et al. 2012, Albertsen, Garde et al. 2014, Hansen, Nabe-Nielsen et al. 2015), while often using similar datasets. It is possible that connections between these studies are present or that datasets overlap with each other. On the other side, the descriptive studies have a lower quality and most of them only describe one (often their own) ward in one hospital. This can, among other things, result in a researcher that is too closely involved with the implementation process, leading to a more subjective representation of the results. Finally, although most studies applied a study duration of twelve months, there were studies that performed their evaluation earlier (with a minimum

of four months). It is often stated that the implementation of self-scheduling requires time, whereby a follow-up period of less than 1 year may be too short to demonstrate significant results. Moreover, a follow-up time exceeding this twelve month period might reveal other long-term consequences. Finally, no study describes or identifies a theory that underlies the intervention or its association with the preselected outcomes, that is, how the intervention is thought to work and its expected impact.

Implications for future research and policy

Notwithstanding these limitations, the findings in this review have several implications.

First, some studies have demonstrated improved satisfaction with scheduling, an increased work-time influence and positive effects on work/life balance, yet also a decrease in general working conditions (including a decreased social support from supervisors). In addition, for other outcomes, the authors did not find any statistically significant results, revealed opposing results or have not yet appropriately tested them. This review reveals that the evidence base is too thin and insufficient to make strong statements about the association between self-scheduling and specific outcomes.

Second, the literature on complex interventions using the MRC framework is thick, although practical advice on how these interventions should be dealt with is scarce (Datta and Petticrew 2013). However, most of the studies in this review gave practical tips to ensure that future policy can be adjusted according to lessons learned in the past. Tips for a successful implementation include: consider structural preconditions (team-based approach in which all employees are involved in the decision & continuous support and involvement of the head nurse); drawn upon past experience in other settings; assess the nursing workload; invest in training (introducing the system requires that employees understand the rostering problem and the implications of their shift allocation decisions); use a mock self-schedule for a month (while continuing with the current roster system); introduce the system in small wards, use guidelines and update them as needed (it is impossible to anticipate all the “what-ifs”, but it is possible to adapt to a “here it is”); provide communication and assertiveness training; use a computerised self-scheduling system; include an objective independent facilitator in the early stages of the implementation; take into account that the process will not always run smoothly and changes will become necessary; use a self-scheduling committee to shoulder the responsibility of the implementation; pay the self-schedulers for completing the schedule; regular evaluation is crucial (discuss at a staff meeting or use a survey) and do not hurry the process. On the other

hand, barriers to a successful implementation include: underestimation of how sensitive the schedule is to employees; lack of consistency in following the guidelines; lack of training (ward demands may be overlooked, negotiation skills underdeveloped); problems with the lack of predictability; wrong perception of individual entitlement (instead of a joint agreement to enhance both the employees their lives and the functioning of the ward); IT problems; competition between employees (to gain preferred dates, peer pressure, favouritism); other major changes that take place at the same time; large ward and unavailability of staff (being short staffed makes rostering more difficult since the possible permutations are reduced).

Third, commitment of the staff does not grow unless they feel that this staffing method is fair and impartial. This means that the less popular shifts (e.g. Wednesday and Friday evening) are equally distributed among the staff and that all employees have the same opportunity to be the first to complete their preferred schedule. In addition, the focus should be obtaining a balance between employees gaining control of their schedule and nurse managers ensuring quality of patient care. For this reason, special attention should be given to the concept of justice or fairness when implementing self-scheduling.

Fourth, future research should employ multimethod longitudinal studies, detailing the processes through which the interventions were developed, implemented and evaluated. In this, a particular challenge will be to determine when a nursing ward is ready for this change and how the transition should be managed. Furthermore, research should include patient-centred outcomes to a greater extent, integrate staff as well as management perceptions, and try to increase the sample size while focussing on multiple comparable healthcare settings (e.g. hospitals). Finally, a theoretical framework should be drafted that identifies which features of the intervention are probably important in affecting the outcomes as well as the sustainability of the self-scheduling method.

CONCLUSION

In this study, we reviewed the available evidence on the relationship between self-scheduling and patient, employee- and organisation-related outcomes. Our analysis, subdivided into exploratory and descriptive studies, showed statistically significant results for an increased satisfaction with scheduling, an increased work-time influence and positive effects on work/life balance, yet also a decrease in general working conditions (including a decreased social support

from supervisors). In addition, for other outcomes, the authors did not find any statistically significant results, revealed opposing results or have not yet appropriately tested them. This review reveals that the evidence base is too thin and insufficient to make strong statements about the relationship between self-scheduling and these specific outcomes. A notable feature is the challenge to implement and sustain the system of self-scheduling. Future research should employ multimethod longitudinal studies, include patient-centred outcomes, integrate staff as well as management perceptions and employ a theoretical framework that gives attention to the concept of fairness or justice.

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CONFLICT OF INTEREST

No conflict of interest.

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TABLES AND FIGURES

Table 2: Inclusion and exclusion criteria

(1) The study must report on evaluation of an implementation of self-scheduling, or make a comparison between self-scheduling and another scheduling technique.
(2) The studies had to assess organisation, nurse or patient outcomes. Since there is no established subdivision of these outcomes, we included all outcomes studied.
(3) All nurses (registered nurse or licensed practical nurse) and assistive personnel or their international equivalents were included. The personnel needed to work in a healthcare organisation.
(4) Quantitative (non-)randomized studies, quantitative descriptive studies (including case reports) and qualitative studies were all included provided that they were published in a peer review journal. Systematic reviews, meta-analyses, theoretical analysis, conference proceedings and personal narratives were excluded.
(5) Studies written in English, Dutch and French were considered. Studies conducted in developing countries were excluded.

Figure 1: Flowchart of data extraction process

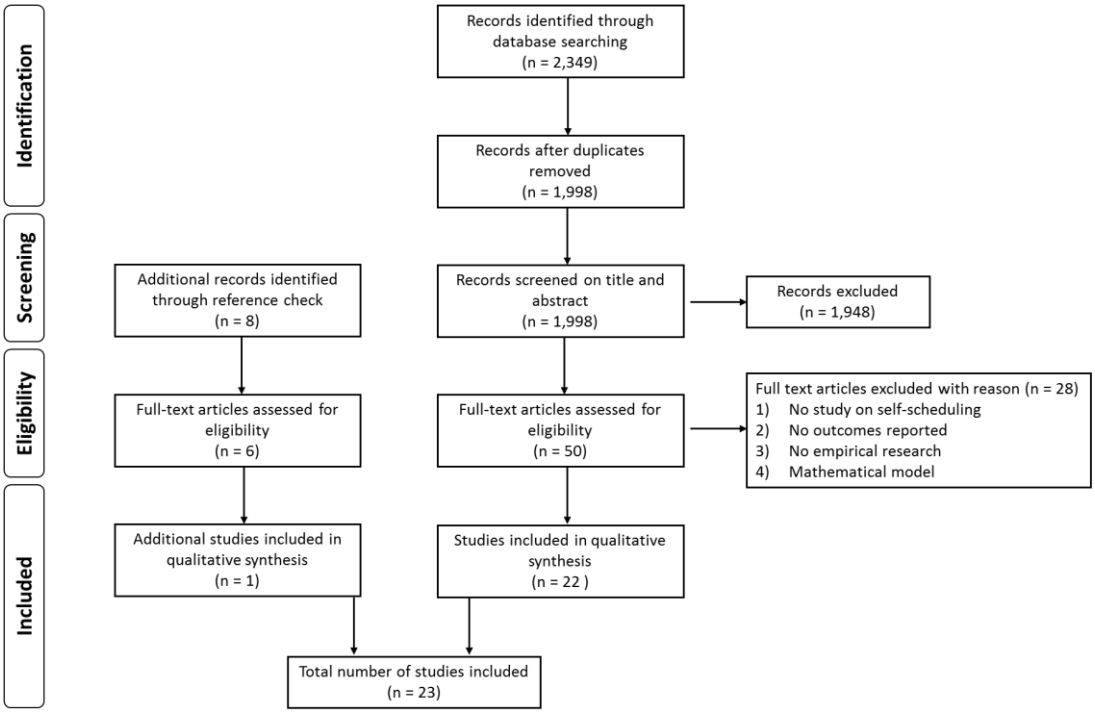

Table 2: Quality appraisal

Exploratory research

Quantitative non-randomized studies	Are there clear research questions?	Do the collected data allow to address the research questions?	Are the participants representative of the target population?	Are measurements appropriate regarding both the outcome and intervention (or exposure)?	Are there complete outcome data?	Are the confounders accounted for in the design and analysis?	During the study period, is the intervention administered (or exposure occurred) as intended?
Nabe-Nielsen, K., Garde, A. H., & Diderichsen, F. (2011)	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes
Ingre, M., Åkerstedt, T., Ekstedt, M., & Kecklund, G.	Yes	Yes	No	Yes	No	Yes	Yes

Mixed methods studies	Are there clear research questions?	Do the collected data allow to address the research questions?	Is there an adequate rationale for using a mixed methods design to address the research question?	Are the different components of the study effectively integrated to answer the research question?	Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?
Pryce, J., Albertsen, K., & Nielsen, K. (2006).	Yes	Yes	Yes	Yes	Yes	Can't tell	No
Garde, A. H., Nabe-Nielsen, K., & Aust, B. (2011)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes
Nabe-Nielsen, K., Garde, A. H., Aust, B., & Diderichsen, F.	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes
Garde, A. H., Albertsen, K., Nabe-Nielsen, K., et al.	Yes	Yes	Yes	Yes	Yes	Can't tell	No
Albertsen, K., Garde, A. H., Nabe-Nielsen, K., et al.	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes
Hansen, A. M., Nabe-Nielsen, K., Albertsen, K., et al.	Yes	Yes	Yes	No	Yes	Can't tell	No
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Yes	Yes	Yes	No	Yes	Can't tell	No

Table 2: Quality appraisal (continued)

Descriptive research

Quantitative descriptive studies	Are there clear research questions?	Do the collected data allow to address the research questions?	Is the sampling strategy relevant to address the research question?	Is the sample representative of the target population?	Are the measurements appropriate?	Is the risk of nonresponse bias low?	Is the statistical analysis appropriate to answer the research question?
Miller, M. L. (1984).	Yes	Yes	Can't tell	Can't tell	No	No	N.A.
Hawkins, T., & Sutton, K. (1991).	Yes	Yes	Can't tell	Can't tell	No	No	N.A.
McCoy, A. K. (1992).	Yes	Yes	Can't tell	Can't tell	No	No	N.A.
Miller, N. (1992).	Yes	Yes	Can't tell	Can't tell	No	No	N.A.
Hensinger, B., Harkins, D., & Bruce, T. (1993).	Yes	Yes	Can't tell	Can't tell	No	No	N.A.
Abbott, M. E. (1995).	Yes	Yes	Yes	Can't tell	No	No	Yes
Ball J (1997).	Yes	Yes	Can't tell	Can't tell	No	Can't tell	N.A.
Teahan, B. (1998).	Yes	Yes	Can't tell	Can't tell	No	Can't tell	N.A.
Silvestro, R., & Silvestro, C. (2000).	Yes	Yes	Yes	Yes	Yes	Can't tell	N.A.
Vetter, E., Felice, L. D., & Ingersoll, G. L. (2001).	Yes	Yes	Can't tell	Can't tell	No	Can't tell	N.A.
Wortley, V., & Grierson-Hill, L. (2003).	Yes	Yes	Can't tell	Can't tell	No	No	N.A.
Bailyn, L., Collins, R., & Song, Y. (2007).	Yes	Yes	Can't tell	Yes	No	Can't tell	N.A.
Wright, C., McCartt, P., Raines, D., & Oermann, M. H.	Yes	Yes	Yes	Can't tell	Yes	Can't tell	N.A.

Qualitative studies	Are there clear research questions?	Do the collected data allow to address the research questions?	Is the qualitative approach appropriate to answer the research question?	Are the qualitative data collection methods adequate to address the research question?	Are the findings adequately derived from the data?	Is the interpretation of results sufficiently substantiated by data?	Is there coherence between qualitative data sources, collection, analysis and interpretation?
Richmond, Janice, and Marguerite Greenhill. (2003).	Yes	Yes	No	No	Can't tell	No	No

Table 3: Study characteristics

Reference	*Design*	*Setting*	*Sample size (healthcare, using self-scheduling)*	*Functions (healthcare)*	*Self-scheduling method*	*Analysis*
Exploratory research						
Pryce, J., Albertsen, K., & Nielsen, K. (2006).	Longitudinal experimental design (randomized)	Hospital (psychiatric)	1 hospital, 86 personnel*	Nurse, health care worker	-	Repeated measures MANOVA
Nabe-Nielsen, K., Garde, A. H., & Diderichsen, F. (2011).	Longitudinal quasi-experimental design (mix of randomized and non-randomized)	Elderly care	3 workplaces, 35 personnel*	Auxiliary nurse, social/nursing home/health care assistant, unskilled	Computerised	Linear mixed model, generalized linear model (GEE) Chi-square test, Kruskal–Wallis test, t-test, Mann-Whitney U test
Garde, A. H., Nabe-Nielsen, K., & Aust, B. (2011).	Longitudinal quasi-experimental design (mix of randomized and non-randomized)	Elderly care	3 workplaces, 34 personnel*	Employee (not specified)	Computerised	Generalized linear model (GEE) Kruskale-Wallis test
Nabe-Nielsen, K., Garde, A. H., Aust, B., & Diderichsen, F. (2012).	Longitudinal quasi-experimental design (non-randomized)	Elderly care	3 workplaces, 34 personnel*	Auxiliary nurse, social/nursing home assistant, unskilled	Computerised	Generalized linear model (GEE)
Ingre, M., Åkerstedt, T., Ekstedt, M., & Kecklund, G. (2012).	Cross-sectional design	Hospital, call-centre, police	1 hospital, 134 personnel*	Employee (not specified)	Computerised	Mixed ANOVA Ordinal logistic regression
Garde, A. H., Albertsen, K., Nabe-Nielsen, K., et al. (2012).	Longitudinal quasi-experimental design (non-randomized)	Hospital, call centre	13 workplaces, 394 personnel*	Employee (not specified)	Computerised	Linear mixed model, generalized linear model (GEE)
Albertsen, K., Garde, A. H., Nabe-Nielsen, K., et al. (2014).	Longitudinal quasi-experimental design (non-randomized)	Hospital, psychiatric home, home for retarded people, call centre	394 personnel*	Employee (not specified)	Computerised	Linear mixed model, generalized linear model (GEE)

** Sample size survey intervention group at baseline*
*** sample size survey after implementation of self-scheduling*

Table 3: Study characteristics (continued)

Reference	*Design*	*Setting*	*Sample size (healthcare, using self-scheduling)*	*Functions (healthcare)*	*Self-scheduling method*	*Analysis*
Exploratory research						
Hansen, A. M., Nabe-Nielsen, K., Albertsen, K., et al. (2015).	Longitudinal quasi-experimental design (non-randomized)	Hospital, call centre	13 workplaces, 394 personnel*	Employee (not specified)	Computerised	ANCOVA with repeated measures, ANOVA
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Longitudinal quasi-experimental design (non-randomized)	(University) hospital	1 university hospital, 2 wards 46 personnel* 73 patients*	Nurse, assistant nurse, physician, unknown	-	Linear regression analysis, two-sample t-test, fisher's exact test
Descriptive research						
Miller, M. L. (1984).	Case report	Hospital	1 hospital, 1 ward	Registered nurse, licensed practical nurse, nursing assistant	Manual	N.A.
Hawkins, T., & Sutton, K. (1991).	Case report (quantitative & qualitative)	Hospital	1 hospital, 1 ward, 56 personnel **	Registered nurse	Manual	N.A.
McCoy, A. K. (1992).	Case report (quantitative)	Hospital	1 hospital, 1 ward, 50 personnel **	Nurse	Manual	N.A.
Miller, N. (1992).	Case report (quantitative)	Hospital	1 hospital, 1 ward, 22 personnel **	Nurse	Manual	N.A.
Hensinger, B., Harkins, D., & Bruce, T. (1993).	Case report (quantitative & qualitative)	Burn centre	1 centre, 2 units, 17 personnel **	Nurse	Manual	N.A.

** Sample size survey intervention group at baseline*
*** sample size survey after implementation of self-scheduling*

Table 3: Study characteristics (continued)

Reference	*Design*	*Setting*	*Sample size (healthcare, using self-scheduling)*	*Functions (healthcare)*	*Self-scheduling method*	*Analysis*
Descriptive research						
Abbott, M. E. (1995).	Case report (quantitative)	Hospital	1 hospital, 1 ward, 27 personnel **	Registered nurse, licensed practical nurse, cardiac monitor technician, unit clerk	Manual	Paired t-test
Ball J (1997).	Case report (quantitative & qualitative)	Hospital	3 hospitals, 3 wards, 53 personnel **	Employee (not specified)	Computerised	N.A.
Teahan, B. (1998).	Case report	Hospital	1 hospital, 1 ward	Nurse	Manual	N.A.
Silvestro, R., & Silvestro, C. (2000).	Case report (quantitative & qualitative)	Hospital	2 hospitals, 2 wards	Nurse	-	N.A.
Vetter, E., Felice, L. D., & Ingersoll, G. L. (2001).	Case report (quantitative)	Hospital	1 hospital, 1 ward	Nurse	Manual	N.A.
Richmond, Janice, and Marguerite Greenhill. (2003).	Case report (qualitative)	Hospital	1 hospital, 1 ward, 28 personnel **	Nurse	Manual	N.A.
Wortley, V., & Grierson-Hill, L. (2003).	Case report (quantitative)	Hospital	1 hospital, 3 wards, 34 personnel*	Registered nurse, non-registered nurse	Manual	N.A.

** Sample size survey intervention group at baseline*
*** sample size survey after implementation of self-scheduling*

Table 3: Study characteristics (continued)

Reference	*Design*	*Setting*	*Sample size (healthcare, using self-scheduling)*	*Functions (healthcare)*	*Self-scheduling method*	*Analysis*
Descriptive research						
Bailyn, L., Collins, R., & Song, Y. (2007).	Case report (quantitative & qualitative)	Hospital	1 hospital, 1 ward	Nurse	Manual	N.A.
Wright, C., McCartt, P., Raines, D., & Oermann, M. H. (2017).	Case report (quantitative)	Hospital	4 hospitals, 54 wards preimplementation, 1,317 personnel*	Registered nurse	Computerised	N.A.

** Sample size survey intervention group at baseline*
*** sample size survey after implementation of self-scheduling*

Table 4: Results per outcome

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Patient outcomes						
Quality of care						
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Exploratory	No statistically significant differences were found between the intervention and control wards, neither at baseline nor at follow-up.	-	Implementation of fixed scheduling (= intervention) compared to self-scheduling (control).	9 months	Type of scheduling did not affect patient-reported outcomes. Further research is necessary and should explore patient outcomes to a greater extent.
Staff-related outcomes						
Job satisfaction						
Pryce, J., Albertsen, K., & Nielsen, K. (2006).	Exploratory	Significant difference between time 1 and time 2 in job satisfaction ($F(175)= 3.18$, $p < 0.01$).	- Process encouraged important discussions about the daily work, resulting in higher levels of energy and satisfaction; - More satisfied with work hours and less likely to swap shifts.	Intervention group developed a project appropriate for their team.	20 months	Suggestion of an effective intervention to enhance job satisfaction within nursing teams.
Hansen, A. M., Nabe-Nielsen, K., Albertsen, K., et al. (2015).	Exploratory	Intervention A: negative effect on job satisfaction ($\beta = -0.18$, 95% CI: -0.28 to -0.07) when adjusting for the changes in perceived influence on working hours. No significant change in Intervention B.	-	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	Job satisfaction decreased when adjusting for perceived influence on the arrangement of working hours in group A, but there was no significant change in the other group.
Satisfaction with self-scheduling						
Garde, A. H., Albertsen, K., Nabe-Nielsen, K., et al. (2012).	Exploratory	- Intervention A: satisfaction with working hours increased (OR 2.5, 95% CI 1.4–4.4); - Intervention B: no significant change.	-	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	Satisfaction with working hours increased in intervention A. No change for intervention B.

* Group of studies are linked to each other ** Group of studies that are linked to each other

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Satisfaction with self-scheduling						
Ingre, M., Åkerstedt, T., Ekstedt, M., & Kecklund, G. (2012).	Exploratory	Personal fit (working hour preference) related to morning, evening and night work was associated with satisfaction with work hours.	-	N.A. (no implementation process)	N.A.	Self-rostering was associated with relative personal fit (with respect to night, evening, morning work).
Ingre, M., Åkerstedt, T., Ekstedt, M., & Kecklund, G. (2012).	Exploratory	Increased need for regularity and predictability, poorer staffing, more frequent compulsory shifts and more conflicts about work hours was associated with poor satisfaction and a preference for fixed and regular schedules.	-	N.A. (no implementation process)	N.A.	Several aspects related to the organization of self-rostering, social aspects and predictability are related to satisfaction with work hours & preference for fixed and regular schedules/self-rostering.
Hawkins, T., & Sutton, K. (1991).	Descriptive	Staff rated self-scheduling as highly satisfying, conventional scheduling as highly dissatisfying.	-	Staff was intimately involved in the project. Managers served as catalysts, consultants.	12 months	Self-scheduling is an effective, efficient, satisfying approach to staffing the CVICU.
McCoy, A. K. (1992).	Descriptive	38/39 or 98% was satisfied with the self-scheduling system.	-	Decision to start discussed among staff. Self-scheduling committee with support of nursing coordinator.	-	Self-scheduling has proven to be a successful joint venture between the staff nurses and the leadership team.
Richmond, Janice, and Marguerite Greenhill. (2003).	Descriptive	-	'- 25/28 or 89% was convinced that self-rostering was or would be successful; - 3/28 or 11% wanted to return to the previous system (difficult to plan their own roster).	Literature was made available & ward manager presented rationale for commencing self-rostering. Staff agreed & a plan was drawn up (including guidelines & pilot).	3 months	Self-rostering should not be embraced just because it is fashionable. The introduction was not without difficulties.

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Work/life balance						
Pryce, J., Albertsen, K., & Nielsen, K. (2006).	Exploratory	A significant difference between time 1 and time 2 in work–life balance ($F(173)= 1.88$, $p < 0.01$).	-	Intervention group developed an intervention appropriate for their team.	20 months	Suggestion of an effective intervention to enhance work–life balance within nursing teams.
Nabe-Nielsen, K., Garde, A. H., & Diderichsen, F. (2011)	Exploratory	No significant effects on the experience of work-family conflicts. In the intervention group, we found a decrease from 32 to 25% in the frequency of reported work–family conflicts with respect to time.	-	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	Surprising that the intervention did not affect the frequency of work–family conflicts. Lack of power due to the limited sample size may explain why these changes were statistically insignificant.
Albertsen, K., Garde, A. H., Nabe-Nielsen, K., et al. (2014).	Exploratory	- Intervention B: work-family conflicts & marital conflicts decreased and work-family facilitation increased from baseline to follow-up; - Intervention A: no statistical significance.	Intervention A: Many employees emphasized that the system had made it easier to comply with family demands and leisure time activities.	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	The largest improvements were found in group B, with almost similar (however, not statistically significant) improvements in group A. The lack of significance in group A may be explained partly by fewer participants in this intervention group.
Ball J (1997).	Descriptive	-	Community ward: previously worked with a fixed yearly rota. Now they only have a few week's notice, which was very unpopular. Mental health & surgical ward: positive difference in ability to do what they wanted outside work.	-	6 months	Self-scheduling was a success in one site, partial success in another, it could not be described as a success in the third.
Wortley, V., & Grierson-Hill, L. (2003).	Descriptive	82% said they were usually able to organise a work and home life balance compared to 38% before the trial.	-	All staff had equal input into the process: introduction, education, setting group norm, development.	6 months	Staff were finding it easier to juggle work/home life balance.
Bailyn, L., Collins, R., & Song, Y. (2007).	Descriptive	-	Self-scheduling was perceived to give more time to spend with their families.	Nursing staff attended a unit meeting to clarify the rules & guidelines. First attempt failed, second attempt divided nurses into 3 groups.	12 months	Because the nurses did not adhere to the rules of the programme, the attempt floundered. During the pilot nurses felt that they had better control of their time.

* Group of studies are linked to each other ** Group of studies that are linked to each other

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Planning involvement						
Nabe-Nielsen, K., Garde, A. H., & Diderichsen, F. (2011)	Exploratory	The odds of being involved in the planning of own working hours were 104 times higher (adjusted OR= 104; 95% CI: 11.6–941, p < 0.001).	-	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	Work-time influence can be increased by implementing self-scheduling via a computer program among part-time working women in the eldercare sector. The intervention did not significantly affect any other outcomes.
Garde, A. H., Nabe-Nielsen, K., & Aust, B. (2011)	Exploratory	Self-scheduling was associated with higher odds ratio (OR = 27; 95%-CI: 7.8-95) for being involved in the planning of one's own working hours (p<0.001).	-	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	The introduction of self-rostering led to higher self-reported influence on working hours.
Nabe-Nielsen, K., Garde, A. H., Aust, B., & Diderichsen, F. (2012).	Exploratory	Variability in terms of the frequency of being asked to come to work at short notice: decrease in all groups, but no significant difference between intervention group and reference group.	Participants stated that self-scheduling provided the employer with more advantages than the employees. (e.g. employees could be asked to come to work although they had vetoed against specific working hours).	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	Change in variability could not solely be ascribed to the intervention.
Nabe-Nielsen, K., Garde, A. H., Aust, B., & Diderichsen, F. (2012).	Exploratory	Flexibility: significant increase from 42 to 86% in the opportunity to wish certain shifts (OR = 9.54; 95% CI:2.58–35.3); a significant increase from 21 to 68% in the opportunity to reject certain shifts (OR = 6.77; 95% CI:2.20–20.9).	-	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	During follow-up, the regularity of the working hours decreased while the flexibility increased.
Nabe-Nielsen, K., Garde, A. H., Aust, B., & Diderichsen, F. (2012).	Exploratory	The odds of reporting changes in the planning of the working hours (OR = 17.4; 95% CI: 3.71–81.6, p < 0.001) and changes in the actual working hours (OR = 5.65; 95% CI: 1.73–18.4, p = 0.004) were significantly increased.	The implementation of computerised self-scheduling implied major changes with respect to how the working hours were planned.	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	The lack of a predetermined pattern in the distribution of the working hours made the planning of work tasks and private appointments more difficult.

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Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Planning involvement						
Nabe-Nielsen, K., Garde, A. H., Aust, B., & Diderichsen, F. (2012).	Exploratory	Significant decrease in the regularity of shifts from 94 to 25% (OR = 0.05; 95% CI: 0.01–0.33). Decrease in the predictability, but this change did not differ significantly between the intervention and the reference group.	Staff would have preferred a longer period of advanced notification for the prescribed working hours (especially for weekend work). Only announcements a long time in advance could be taken into account. Keeping good opportunities for exchanging shifts with colleagues is essential.	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	During follow-up the regularity of the working hours decreased. The predictability declined across all groups (also reference): these changes can not solely be ascribed to the intervention.
Garde, A. H., Albertsen, K., Nabe-Nielsen, K., et al. (2012).	Exploratory	- Intervention A: increased odds of shifts lasting ≤4 hours (OR=4.8, 95% CI 1.9–12.3) or ≥9 hours (OR=4.8, 95% CI 2.9–8.0). Mean shift length was increased (β=0.69, 95% CI 0.21–1.17); - Intervention B: no statistically significant changes in working hours were observed.	-	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	Employees changed shift length and timing, when offered the opportunity, but did not compromise most recommendations for design of acceptable shift work schedules.
Garde, A. H., Albertsen, K., Nabe-Nielsen, K., et al. (2012).	Exploratory	Influence on working hours increased significantly in intervention A (OR 5.9, 95% CI 3.2–11.0) and intervention B (OR 3.3, 95% CI 2.1–5.3). Increased possibility to prefer different lengths of duty (Intervention A), time of day ((Intervention A) and what day to work (Intervention A and B).	-	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	Implementation of self-rostering is followed by increased influence on working hours. The effects could be even larger, because employees already had some influence on working hours in terms of the preferences before the introduction of self-rostering.
Hansen, A. M., Nabe-Nielsen, K., Albertsen, K., et al. (2015).	Exploratory	Intervention B: decreased quantitative demands (β = 0.28, 95% CI: 0.4 to 0.15) and decreased work pace (β = 0.23, 95%: 0.38 to 0.08). Adjusting for changes in perceived influence on the arrangement of working hours, only changed the results marginally.	-	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	A decrease in quantitative demands & work pace was observed in intervention B & not for intervention A. Self-rostering may have a positive effect on job demands, especially if the intervention does not comprise drastic changes of the organisation of the work and private life.

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Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Planning involvement						
Hansen, A. M., Nabe-Nielsen, K., Albertsen, K., et al. (2015).	Exploratory	Self-rostering was associated with increased influence on working hours in intervention A (β= 0.20, 95% CI: 0.05-0.34).	-	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	Adjusting for changes in perceived influence on the arrangement of working hours had the largest impact in group A, which indicates that the effect of the intervention relates, e.g., to the implementation process and other contextual factors. Group B: the influence on working hours was successfully increased without radical changes which made it easier for the employees to adjust to
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Exploratory	Trading and changing of shifts became more difficult after the implementation of fixed scheduling (p = 0.01).	-	Implementation of fixed scheduling (= intervention) compared to self-scheduling (control).	9 months	Staff with self-scheduling reported more short notice shift changes. Even if self-scheduling is associated with more flexibility, more shift changes are requested at short notice, which might have a negative effect on planning.
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Exploratory	Fixed scheduling group found that they were less often asked to change shifts at short notice compared to the self-scheduling (p = 0.002).	-	Implementation of fixed scheduling (= intervention) compared to self-scheduling (control).	9 months	Staff with self-scheduling reported more short notice shift changes. Even if self-scheduling is associated with more flexibility, more shift changes are requested at short notice, which might have a negative effect on planning.
Hawkins, T., & Sutton, K. (1991).	Descriptive	- Advantages according to the staff: option to take time off during low census periods (73%), control over personal/professional schedule (71%); - Disadvantages according to the staff: having to work shifts or days off (67%), inability to work enough during low census periods (61%).	-	Staff was intimately involved in the project. Managers served as catalysts, consultants.	12 months	Self-scheduling is an effective, efficient, satisfying approach to staffing the CVICU.

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Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Planning involvement						
Hensinger, B., Harkins, D., & Bruce, T. (1993).	Descriptive	-	Control and flexibility were cited as benefits.	Need for change expressed by ward, staff was involved in project: nurse-retention committee was formed, guidelines drafted. In-service programs were arranged.	6 months	Involving staff nurses in creating their own schedules fosters feelings of control & willingness to participate.
Teahan, B. (1998).	Descriptive	-	Demand for certain days off could not always be met (e.g. most staff members did not wish to work in Friday preceding or on the Monday after their weekend off).	Self-scheduling was introduced as a pilot project. Staff was involved in the project.	-	Apart from the benefits, complaints of peer pressure, favouritism and unavailability of staff on certain shifts also emerged.
Richmond, Janice, and Marguerite Greenhill. (2003).	Descriptive	-	Staff said they could plan better (n=5), they had fewer periods with 8-10 consecutive days to work (n=2).	Literature was made available & ward manager presented rationale for commencing self-rostering. Staff agreed & a plan was drawn up (including guidelines & pilot).	3 months	Self-rostering should not be embraced just because it is fashionable. The introduction was not without difficulties.
Bailyn, L., Collins, R., & Song, Y. (2007).	Descriptive	-	Need for control and flexibility both decreased gradually as the self-scheduling implementation progressed. Nearly all respondents commented that self-scheduling offered them more flexibility at the workplace.	The nursing staff attended a unit meeting to clarify the rules and guidelines. First attempt failed, second attempt divided nurses into 3 groups.	12 months	Because the nurses did not adhere to the rules of the programme, the attempt floundered. During the pilot nurses felt that they had better control of their time.

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Interaction with colleagues						
Pryce, J., Albertsen, K., & Nielsen, K. (2006).	Exploratory	A significant difference between time 1 and time 2 in social support and sense of community [$F(174) = 4.05$, $p < 0.01$ and $F(176) = 4.44$, $p < 0.001$ respectively].	- Team members reported an increased level of Team awareness within the groups; - Some participants reported that they experienced competition in being the first to allocate their preferred shifts.	Intervention group developed an intervention appropriate for their team.	20 months	Suggestion of an effective intervention to support and cooperation within nursing teams. However, the intervention was not received without problems.
Nabe-Nielsen, K., Garde, A. H., & Diderichsen, F. (2011)	Exploratory	Social support from leaders and colleagues increased significantly (overall group*time interaction, $p = 0.037$; self-scheduling group: $\beta = 6.71$; 95% CI: 0.09–13.33).	-	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	The experience of social support was improved during the study period.
Ingre, M., Åkerstedt, T., Ekstedt, M., & Kecklund, G. (2012).	Exploratory	Conflicts at the workplace about work hours and the perceived need to know one's co-workers well was associated with preference for a fixed schedule.	-	N.A. (no implementation process)	N.A.	When everybody works their own schedule (self-scheduling) tight groups working together with colleagues they know well will be scarce & this might be a stressor/source of insecurity for some individuals.
Hansen, A. M., Nabe-Nielsen, K., Albertsen, K., et al. (2015).	Exploratory	Intervention B: increased social community at work ($\beta = 0.15$, 95%: 0.03-0.27), and increased social support from colleagues ($\beta = 0.23$, 95%: 0.09 - 0.38).	-	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	Results showed that social support from colleagues increased significantly in the intervention group compared to the reference group, adjusting for perceived influence on the arrangement of working hours did not change this result.
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Exploratory	Significant difference ($p = 0.047$) between fixed and self-scheduling group regarding team spirit: the share of positive respondents in the self-scheduling group decreased.	-	Implementation of fixed scheduling (= intervention) compared to self-scheduling (control).	9 months	There was a statistically significant difference regarding team spirit. However, this depended on a decrease in the self-scheduling (control) group. This was quite surprising and we might need more points of measurements and longer time periods to capture this phenomenon.

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Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Interaction with colleagues						
Miller, M. L. (1984).	Descriptive	-	- New team spirit developed among staff; - A more cooperative attitude developed between staff nurses and nursing administration.	Staff was involved in the process. Meetings were held to identify problems with the existing scheduling system, present self-scheduling as an alternative, establish a few practice sessions.	-	Self-scheduling increases perception of autonomy among staff nurses and becomes an effective tool in the recruitment and retention of staff nurses.
Hawkins, T., & Sutton, K. (1991).	Descriptive	-	Implementation of self-scheduling has enhanced trust and collegial relationships among the staff.	Staff was intimately involved in the project. Managers served as catalysts, consultants.	12 months	Self-scheduling is an effective, efficient, satisfying approach to staffing the CVICU.
Miller, N. (1992).	Descriptive	-	Relationships between members of various shifts have improved (this has helped the night shift).	Staff was intimately involved in the project. Guidelines were established. Staff members acted as schedule coordinators on a rotating basis.	9 months	Self-scheduling can be an effective incentive for both recruitment and retention.
Abbott, M. E. (1995).	Descriptive	Fellow staff are willing to negotiate with each other (T=-2.65, P=0.02, n=11).	-	Staff was intimately involved in the project. A self-scheduling committee (volunteers), developed guidelines and assumed responsibility for scheduling and covering call-ins.	4 months	Positive experience, but there are elements that need to be refined. If negotiation skills are not developed, staff members become frustrated.
Ball J (1997).	Descriptive	87% in the community ward said that it had created more tension among staff (compared with 18% in the mental health unit).	The whole principle of choice had increased their morale and made them more motivated about their work (mental health ward).	-	6 months	Community ward: most staff had been working a long time with fixed yearly rolling rota and were happy wit the system. The lack of notice in the self-scheduling system was very unpopular. Mental health ward: made full use of the Time Bank and the variable shift times.

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Interaction with colleagues						
Teahan, B. (1998).	Descriptive	-	- Morale increased & the staff was generally more content; - Complaints of favouritism by the schedulers; - Frequent scrutinization by staff of the duty schedule other colleagues received.	Self-scheduling was introduced as a pilot project. Staff was involved in the project.	-	When staff managed the project, dissatisfaction decreased. The gap between management and staff narrowed. However, complaints of peer pressure, favouritism and unavailability of staff on certain shifts also emerged.
Silvestro, R., & Silvestro, C. (2000).	Descriptive	-	Ward managers felt that team spirit had improved because staff needed to co-operate and negotiate shift allocations. Managers emphasized the importance of in training the staff to understand the rostering problem and to appreciate the implications of their shift allocation decisions.	N.A. (no implementation process)	N.A.	Self-rostering works most effectively in small wards which have a simple rostering problem because each member of the staff has not only to perceive the rostering problem but also its solution.
Health and well-being						
Pryce, J., Albertsen, K., & Nielsen, K. (2006).	Exploratory	No significant benefits to health and well being as measured by general health, somatic, behavioural or cognitive symptoms or vitality, were found.	-	Intervention group developed an intervention appropriate for their team.	20 months	No significant benefits to health and well being were found. It is recognized that such benefits are difficult to capture in intervention studies of this nature.
Nabe-Nielsen, K., Garde, A. H., & Diderichsen, F. (2011)	Exploratory	No significant effects on serum lipids or testosterone.	-	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	No support for the theory that increased work-time influence improves health and well-being.

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Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Health and well-being						
Garde, A. H., Nabe-Nielsen, K., & Aust, B. (2011)	Exploratory	No significant effect for any of the sleep parameters.	-	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	The introduction of self-rostering led to higher self-reported influence on working hours. The lack of effect on sleep quality may be due to theory failure.
Garde, A. H., Albertsen, K., Nabe-Nielsen, K., et al. (2012).	Exploratory	- Need for recovery decreased in intervention A (β= -0.17, 95% CI -0.29–-0.04) and intervention B (β= -0.17, 95% CI -0.27– -0.07). - Intervention B: fewer somatic symptoms (β= -0.10 95% CI -0.19– -0.02), less mental distress (β= -0.13, 95% CI -0.23– -0.03) better sleep (β= 0.17 95% CI 0.04–0.30).	-	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	Self-rostering was associated with changes in working hours in intervention A, improved health in intervention B, less need for recovery in both interventions A and B. No detrimental effects on the need for recovery, sleep, or health were found. The study could not confirm that changes in health were mediated through changes in working hours.
Psychosocial factors						
Pryce, J., Albertsen, K., & Nielsen, K. (2006).	Exploratory	-	some participants reported that they felt insecure and uncomfortable with the increased responsibility of the fine-tuning of the rota.	Intervention group developed an intervention appropriate for their team.	20 months	Suggestion of an effective intervention to enhance job satisfaction, work–life balance, support and cooperation within nursing teams. No significant benefits to health and well being were found.
Albertsen, K., Garde, A. H., Nabe-Nielsen, K., et al. (2014).	Exploratory	-	Intervention B: Employees expressed in the interviews that the system increased justice in the work schedule.	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	An overall positive effect of the implementation of self-rostering was found on the balance between work and private life. However, results from the process evaluation suggested that the organizational aim with the intervention was crucial for the effect.

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Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Psychosocial factors						
Teahan, B. (1998).	Descriptive	-	Staff also felt empowered to peruse other projects that improved services and care for patients and families.	Self-scheduling was introduced as a pilot project. Staff was involved in the project.	-	When staff managed the project, dissatisfaction, absenteeism and costs decreased. The gap between management and staff narrowed and staff utilized the process as a continuing education project.
Silvestro, R., & Silvestro, C. (2000).	Descriptive	-	Junior staff were given considerably less discretion over shift allocations than senior staff nurses, which was leading to perceived inequity in implementation and a dilution, or fragmentation, of the self-rostering approach (ward 2).	N.A. (no implementation process)	N.A.	Self-rostering works most effectively in small wards which have a simple rostering problem. Ward 2: In practice, it was the more senior grades of staff who were self-rostering, the junior staff being allocated the remaining shifts.
Vetter, E., Felice, L. D., & Ingersoll, G. L. (2001).	Descriptive	80% perceived the process used for self-scheduling as fair and equitable.	-	The nurse manager encouraged staff members to come up with a creative scheduling process. She avoided prescribing any particular approach and provided whatever support was needed.	6 months	Self-scheduling is a mechanism for recognizing and rewarding staff members who adjust their work schedules to meet the needs of the unit.
Miller, M. L. (1984).	Descriptive	-	Staff felt that they had more autonomy.	Staff was involved in the process. Meetings were held to identify problems with the existing scheduling system, present self-scheduling as an alternative, establish a few practice sessions.	-	Self-scheduling increases perception of autonomy among staff nurses.

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Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Psychosocial factors						
Teahan, B. (1998).	Descriptive	-	Staff also felt empowered to peruse other projects that improved services and care for patients and families.	Self-scheduling was introduced as a pilot project. Staff was involved in the project.	-	When staff managed the project, dissatisfaction, absenteeism and costs decreased. The gap between management and staff narrowed and staff utilized the process as a continuing education project.
Silvestro, R., & Silvestro, C. (2000).	Descriptive	-	Junior staff were given considerably less discretion over shift allocations than senior staff nurses, which was leading to perceived inequity in implementation and a dilution, or fragmentation, of the self-rostering approach (ward 2).	N.A. (no implementation process)	N.A.	Self-rostering works most effectively in small wards which have a simple rostering problem. Ward 2: In practice, it was the more senior grades of staff who were self-rostering, the junior staff being allocated the remaining shifts.
Vetter, E., Felice, L. D., & Ingersoll, G. L. (2001).	Descriptive	80% perceived the process used for self-scheduling as fair and equitable.	-	The nurse manager encouraged staff members to come up with a creative scheduling process. She avoided prescribing any particular approach and provided whatever support was needed.	6 months	Self-scheduling is a mechanism for recognizing and rewarding staff members who adjust their work schedules to meet the needs of the unit.
Miller, M. L. (1984).	Descriptive	-	Staff felt that they had more autonomy.	Staff was involved in the process. Meetings were held to identify problems with the existing scheduling system, present self-scheduling as an alternative, establish a few practice sessions.	-	Self-scheduling increases perception of autonomy among staff nurses.

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Psychosocial factors						
Wright, C., McCartt, P., Raines, D., & Oermann, M. H. (2017).	Descriptive	RNs' perceptions of their autonomy in their positions increased across all four hospitals.	-	Technical staff facilitated and implemented the project across all the hospitals. Demonstrations and timelines were presented to the nurse executives and managers. Training and information was given to administrative users and all RNs.	12 months	The nurses across all hospitals increased in their perceptions of autonomy. Although autonomy of the nurses increased after they were able to schedule their own work times, other factors also might have affected these scores.
Quality of care						
Nabe-Nielsen, K., Garde, A. H., Aust, B., & Diderichsen, F. (2012).	Exploratory	-	Due to the individualised work schedules, the staff now had to co-operate with more colleagues during a working week. Staff expressed that it was easier to take good care of the clients when working together with colleagues that they knew well.	* Intervention group planned, implemented and financed their own intervention. Scientific recommendations where presented by researchers.	12 months	An anticipated negative effect of more flexible working hours was a decreased continuity in the care of clients and contacts with colleagues.
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Exploratory	No significant differences were found between the intervention and comparison wards with regard to how the staff rated patient continuity.	More than half of the respondents reported that stress affected patient safety in a negative way, regardless of scheduling model or overtime.	Implementation of fixed scheduling (= intervention) compared to self-scheduling (control).	9 months	Further research is necessary and should explore patient outcomes to a greater extent.
Hawkins, T., & Sutton, K. (1991).	Descriptive	-	We believe that the quality of patient care has improved as only experienced cardiovascular nurses are caring for the patient (e.g. no agency nurses).	Staff was intimately involved in the project. Managers served as catalysts, consultants.	12 months	Self-scheduling is an effective, efficient, satisfying approach to staffing the CVICU.

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Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Staff-related outcomes						
Quality of care						
Miller, N. (1992).	Descriptive	-	Quality of patient care has not been adversely affected + the nurse manager feels that the quality has improved as a result of a more satisfied staff.	Staff was intimately involved in the project. Guidelines were established. Staff members acted as schedule coordinators on a rotating basis.	9 months	Self-scheduling can be an effective incentive for improving patient satisfaction.
Bailyn, L., Collins, R., & Song, Y. (2007).	Descriptive	-	self-scheduling was perceived by the nurses to provide what they felt was better patient care.	The nursing staff attended a unit meeting to clarify the rules and guidelines. First attempt failed, second attempt divided nurses into 3 groups.	12 months	Because the nurses did not adhere to the rules of the programme, the attempt floundered. Nurses perceived their patient care to improve, but it is necessary that everyone keeps both sides (individual employee & the need of the unit) continuously in mind (dual agenda).
Organization-related outcomes						
Professional development						
Pryce, J., Albertsen, K., & Nielsen, K. (2006).	Exploratory	-	Employees noted an improved insight into how the department operated & into the availability and utilization of resources, for example, the costs of absence; the rationale behind task allocation.	Intervention group developed an intervention appropriate for their team.	20 months	The ownership and choice over work–rest schedules has benefits for nurses, and potentially the hospital.
Miller, M. L. (1984).	Descriptive	-	Increased awareness by nursing staff of the unit's need for nursing care.	Staff was involved in the process. Meetings were held to identify problems with the existing scheduling system, present self-scheduling as an alternative, establish a few practice sessions.	-	Self-scheduling increases perception of autonomy among staff nurses.

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Organization-related outcomes						
Professional development						
Miller, N. (1992).	Descriptive	-	Staff did not rank self-scheduling as having an impact on motivation toward increased involvement in nursing/hospital activities, but the manager documented a great change in this area.	Staff was intimately involved in the project. Guidelines were established. Staff members acted as schedule coordinators on a rotating basis.	9 months	Self-scheduling can be an effective incentive for both recruitment and retention as well as for improving patient satisfaction.
Hensinger, B., Harkins, D., & Bruce, T. (1993).	Descriptive	14 of the 15 nurses felt self-scheduling would simplify planning for educational opportunities.	Professional growth was not enhanced (based on attendance at staff meetings and/or work related educational programs).	Need for change expressed by ward, staff was involved in project: nurse-retention committee was formed, guidelines drafted. In-service programs were arranged.	6 months	In theory, the ability to tailor one's own time should increase options for personal and professional growth. However, our study found that professional growth was not enhanced (measured by attendance at staff meetings and/or work related educational programs).
Teahan, B. (1998).	Descriptive	-	Staff became increasingly involved in problem solving that would have previously have been directed to the manager. A more positive climate resulted between management and staff.	Self-scheduling was introduced as a pilot project. Staff was involved in the project.	-	The gap between management and staff narrowed and staff utilized the process as a continuing education project. Staff became more interested in their own development as nursing professionals.
Richmond, Janice, and Marguerite Greenhill. (2003).	Descriptive	-	Better understanding of what it takes to get a ward covered.	Literature was made available & ward manager presented rationale for commencing self-rostering. Staff agreed & a plan was drawn up (including guidelines & pilot).	3 months	Self-rostering should not be embraced just because it is a fashionable concept. The introduction of the system was not without difficulties.

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Organization-related outcomes						
Professional development						
Wright, C., McCartt, P., Raines, D., & Oermann, M. H. (2017).	Descriptive	Nurses' perceptions of their professional development increased in three (out of four) of the hospitals.	-	Technical staff facilitated and implemented the project across all the hospitals. Demonstrations and timelines were presented to the nurse executives and managers. Training and information was given to administrative users and all RNs.	12 months	The majority of nurses perceived an increase in their own professional development. Although professional development scores increased, other factors also might have affected these scores.
General working conditions						
Hansen, A. M., Nabe-Nielsen, K., Albertsen, K., et al. (2015).	Exploratory	Intervention A: self-rostering was associated with a decrease in social support from supervisors (β= -0.27, 95% CI: -0.47 to -0.07). When adjusting for the changes in perceived influence on the arrangement of working hours, the effect increased in a negative direction (β = -0.41, 95% CI: - 0.61 to -0.21).	-	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	Employees in group A experienced a decrease in the social support from their supervisor despite that the intervention successfully increased influence on the arrangement of the working hours.
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Exploratory	Working conditions in general: at follow-up, the proportion of positive respondents decreased for self-scheduling (=control group), while it increased for fixed scheduling ($p<0.0001$).	-	Implementation of fixed scheduling (= intervention) compared to self-scheduling (control).	9 months	Negative changes in staff reported general working conditions in the comparison group: the fact that the changed schedule was implemented on the intervention wards, with possibilities for nursing staff to impact the process, might be an explanation. The comparison wards did not have the same chance to influence the process.

* Group of studies are linked to each other ** Group of studies that are linked to each other

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Organization-related outcomes						
Professional development						
Silvestro, R., & Silvestro, C. (2000).	Descriptive	-	Designing a well balanced roster becomes more difficult as ward size increases. When many individuals are involved in the planning process, the global view of the roster can be lost.	N.A. (no implementation process)	N.A.	In general, self-rostering works most effectively in small wards which have a simple rostering problem because, in order for it to succeed, each member of staff has not only to perceive the rostering problem but also its solution.
Abbott, M. E. (1995).	Descriptive	Difference between pre- and post test: the nurse manager negotiates the changes I need (T 2.35; p=0.04, n=12).	-	A self-scheduling committee, formed from volunteers, developed new administrative guidelines and assumed responsibility for scheduling and covering call-ins.	4 months	Because the nurse manager no longer negotiates the staff changes, they now negotiate with their peers.
Nurse manager's time on scheduling						
Miller, M. L. (1984).	Descriptive	-	Head nurse felt this system reduced time spent on scheduling by 50%.	Staff was involved in the process. Meetings were held to identify problems with the existing scheduling system, present self-scheduling as an alternative, establish a few practice sessions.	-	Self-scheduling reduces time spent by the head nurse in scheduling and virtually eliminates the special request book.
Abbott, M. E. (1995).	Descriptive	Nurse manager spends 95% less time scheduling.	-	A self-scheduling committee, formed from volunteers, developed new administrative guidelines and assumed responsibility for scheduling and covering call-ins.	4 months	Positive experience, but there are elements that need to be refined.

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Organization-related outcomes						
Nurse manager's time on scheduling						
Teahan, B. (1998).	Descriptive	-	There is an increase in manager's time to address other issues.	Self-scheduling was introduced as a pilot project. Staff was involved in the project.	-	The gap between management and staff narrowed.
Vetter, E., Felice, L. D., & Ingersoll, G. L. (2001).	Descriptive	During the early phases, the average time required for each time block was 2 to 4 hours per week for all weeks of the period. The average time required at the end is 4 hours per week for 1 month for each 6-week time block.	-	The nurse manager encouraged staff members to come up with a creative scheduling process. She avoided prescribing any particular approach and provided whatever support was needed.	6 months	Self-scheduling is a mechanism for recognizing and rewarding staff members who adjust their work schedules to meet the needs of the unit.
Richmond, Janice, and Marguerite Greenhill. (2003).	Descriptive	-	The ward manager's time spent planning off-duty schedules was reduced by approximately 75%.	Literature was made available & ward manager presented rationale for commencing self-rostering. Staff agreed & a plan was drawn up (including guidelines & pilot).	3 months	Self-rostering should not be embraced just because it is a fashionable concept. The introduction of the system was not without difficulties.
Bailyn, L., Collins, R., & Song, Y. (2007).	Descriptive	- Time the nurse manager spent to make the monthly nursing schedules decreased; - Number of change requests decreased.	-	The nursing staff attended a unit meeting to clarify the rules and guidelines. First attempt failed, second attempt divided nurses into 3 groups.	12 months	Because the nurses did not adhere to the rules of the programme, the attempt floundered. change requests decreased, as did the time spent by the nurse manager and her sense of annoyance.
Turnover						
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Exploratory	Could not identify any differences or trends in turnover.	-	Implementation of fixed scheduling (= intervention) compared to self-scheduling (control).	9 months	One of the wards in the fixed scheduling group increased the number of beds and employed 18 new nurses during the study period. This could be a confounding factor.

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Organization-related outcomes						
Turnover						
Miller, M. L. (1984).	Descriptive	55% reduction in turnover rate for the unit.	-	Staff was involved in the process. Meetings were held to identify problems with the existing scheduling system, present self-scheduling as an alternative, establish a few practice sessions.	-	Self-scheduling can become an effective tool in the recruitment and retention of staff nurses.
Hawkins, T., & Sutton, K. (1991).	Descriptive	Turnover decline (40% in 1988 to 6% in 1989).	-	Staff was intimately involved in the project. Managers served as catalysts, consultants.	12 months	Self-scheduling is an effective, efficient, satisfying approach to staffing the CVICU.
Miller, N. (1992).	Descriptive	A turnover decrease from four to one (compared with the same period in 1989).	-	Staff was intimately involved in the project. Guidelines were established. Staff members acted as schedule coordinators on a rotating basis.	9 months	Self-scheduling is an effective incentive for both recruitment and retention. Turnover has dropped dramatically.
Teahan, B. (1998).	Descriptive	-	Decrease in staff turnover.	Self-scheduling was introduced as a pilot project. Staff was involved in the project.	-	There was a decrease in staff turnover, which translated to less overall costs for the hospital in terms of advertising and interviewing, staff orientation and resource utilization. Applications to work on the unit multiplied.
Wright, C., McCartt, P., Raines, D., & Oermann, M. H. (2017).	Descriptive	RN Turnover decreased at two of the hospitals (the largest and the smallest in the system) and increased in the two other hospitals.	-	Technical staff facilitated and implemented the project across all the hospitals. Demonstrations and timelines were presented to the nurse executives and managers. Training and information was given to administrative users and all RNs.	12 months	Self-scheduling may play a key role in turnover. The isolated effect of self-scheduling on turnover is not known because of other variables that also influence turnover among RNs in acute care settings.

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Organization-related outcomes						
Agency utilization & absenteeism						
Kullberg, A., Bergenmar, M., & Sharp, L. (2016).	Exploratory	No differences or trends in short-term sick leave between wards with fixed or self-scheduling.	-	Implementation of fixed scheduling (= intervention) compared to self-scheduling (control).	9 months	Overall our study shows relatively low levels of sick leave compared with other studies.
Miller, N. (1992).	Descriptive	11% decrease in use of agency personnel as a result of the staff rotating to the night shift and volunteering for overtime.	-	Staff was intimately involved in the project. Guidelines were established. Staff members acted as schedule coordinators on a rotating basis.	9 months	We think that self-scheduling is an effective incentive for both recruitment and retention as well as for improving patient satisfaction.
Hawkins, T., & Sutton, K. (1991).	Descriptive	Agency utilization decreased from a mean of 0.81 to 0.22 agency hours per patient day	-	Staff was intimately involved in the project. Managers served as catalysts, consultants.	12 months	Self-scheduling is an effective, efficient, satisfying approach to staffing the CVICU.
Miller, N. (1992).	Descriptive	33% decrease in absenteeism.	-	Staff was intimately involved in the project. Guidelines were established. Staff members acted as schedule coordinators on a rotating basis.	9 months	We think that self-scheduling is an effective incentive for both recruitment and retention. Absenteeism has dropped dramatically.
Bailyn, L., Collins, R., & Song, Y. (2007).	Descriptive	The number of sick calls per month remained relatively steady.	-	The nursing staff attended a unit meeting to clarify the rules and guidelines. First attempt failed, second attempt divided nurses into 3 groups.	12 months	Because the nurses did not adhere to the rules of the programme, the attempt floundered. Self-scheduling can have positive results for nurses and benefit the nurse manager. But if nurses see this as an individual entitlement instead of a balance between individual and unit benefit, everyone loses
Teahan, B. (1998).	Descriptive	-	A reduction in sick calls.	Self-scheduling was introduced as a pilot project. Staff was involved in the project.	-	A reduction in sick calls could also indicate that morale had increased. Consequently, the difficulties arising with sick calls also decreased (e.g. uncertainty with agency staff expertise).

Table 4: Results per outcome (continued)

Reference	Exploratory/ descriptive	Quantitative result	Qualitative result	Implementation strategy	Study duration	Conclusion from the author
Organization-related outcomes						
Recruitment and retention						
Albertsen, K., Garde, A. H., Nabe-Nielsen, K., et al. (2014).	Exploratory	-	Intervention A: workplaces reported examples of employees, who had specifically been attracted by the way of organizing the working hours.	** Staff was involved in the process. Intervention A: preferences for starting time and length of shift. Interventions B: number of predefined duties.	12 months	An overall positive effect of the implementation of self-rostering was found on the balance between work and private life. However, results from the process evaluation suggested that the organizational aim with the intervention was crucial for the effect.
Hawkins, T., & Sutton, K. (1991).	Descriptive	Before implementation, we had 2 positions vacant and no waiting list. Now, all positions are filled and 4 nurses are waiting to transfer.	-	Staff was intimately involved in the project. Managers served as catalysts, consultants.	12 months	Self-scheduling is an effective, efficient, satisfying approach to staffing the CVICU.
Silvestro, R., & Silvestro, C. (2000).	Descriptive	-	Better staff retention.	N.A. (no implementation process)	N.A.	In general, self-rostering works most effectively in small wards which have a simple rostering problem because, in order for it to succeed, each member of staff has not only to perceive the rostering problem but also its solution.
Hensinger, B., Harkins, D., & Bruce, T. (1993).	Descriptive	14 of the 16 new nurses who were surveyed post-hire agreed with the statement "I choose the burn unit because the ability to self-schedule was important to me".	-	Need for change expressed by ward, staff was involved in project: nurse-retention committee was formed, guidelines drafted. In-service programs were arranged.	6 months	Nurses were satisfied with their schedules, there were fewer requested changes in assigned days. Involving staff nurses in creating their own schedules fosters feelings of control and willingness to participate.

* Group of studies are linked to each other ** Group of studies that are linked to each other