

## Shift Work and Work-Family Conflict: A Systematic Review

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### *Abstract*

*Shift work occupies precious time for family and social life. The aim of this review was to systematically assess the state of research on the impact of shift work on work-family conflict. A systematic literature search was conducted in PubMed and EBSCO to identify studies published between 1990 and 2017. In the end, 36 articles met the inclusion criteria and were considered in this review. Shift workers show higher levels of work-family conflict in comparison to workers in regular day schedules. Different shift types and a large variation of shift characteristics have been studied. Results point to a higher work-family conflict especially among night shift workers and those working in a shift schedule, including weekend work. Research testing for causality is missing.*

*Key words: shift work; working time; work-life balance; work schedule*

### **Introduction**

On average, more than every fifth employee in the European Union and more than every sixth employee in the U.S. is engaged in some type of shift work (Eurofound 2017; McMenamin 2007). Shift work is necessary to cover services and production 24/7 – for example related to the maintenance of safety, security and energy supply as well as to allow non-stop plant operations, (health) care services, and gastronomic services. This can be evening shifts, night shifts, rotating shifts and weekend shifts, just to name a few. What is common to the different types of shift work is that employees have to work during nonstandard working hours that are outside normal daytime working hours.

Shift work is negatively associated with health and well-being (e.g. Costa 2003). For example, working in shifts is related to an increased risk of accidents (Zhao/Bogossian/Turner 2010),

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to diabetes type 2, and cardiovascular diseases (Knutsson 2003). In their conceptual model, Tucker and Folkard (2012) describe three mechanisms through which shift work affects health: a disturbed body clock, shortened and disturbed sleep, and a disturbed family and social life. Short-term consequences of these disruptions may be fatigue, impaired mood and performance. In the long run, these negative consequences can lead to major health problems. While the examination of effects of shift work on circadian rhythm and sleep have a long tradition in shift research (e.g. Folkard/Mong/Lobban 1978), the role of shift work on employees' family and social life has not been studied with the same intensity (Barnes-Farrell/Davies-Schrils/McGonagle/Walsh/Di Milia/Fischer/Hobbs/Kaliterna/Tepas 2008).

However, interest in this line of research was also triggered by social developments during the last decades: the proportion of two-income households and the engagement of women in paid work have been growing, as well as the interest in employees' quality of work life. These major changes are accompanied by changes in social values concerning the meaning of family life, meaning of work, success and its role in self-fulfillment (Greenhaus/Beutell 1985). Thus, research on the compatibility of work and family receives growing attention; pursuing for instance questions on labour division at home, child care, work schedules and health (Bianchi/Milkie 2010). Against this background, especially the conflict in meeting the demands of the work domain and the family domain (work-family conflict) has emerged to an important and increasingly studied risk factor for well-being and health in occupational research (Hämmig/Gutzwiller/Bauer 2009). Several meta-analyses on consequences of work-family conflict concluded that work-family conflict is associated with different aspects of working life, such as job satisfaction, well-being and health status (e.g. Amstad/Meier/Fasel/Elfering/Semmer 2011; Allen/Herst/Bruck/Sutton 2000). Especially, time-based conflicts between work and family domains may become more important as the increasing heterogeneity of working time models is a challenge for the compatibility of work and family (Beutell 2010). Predominantly, shift work affects the private and family life in a particular way, because it occupies precious time for family and private life (Barnes-Farrell et al. 2008) and hinders engaging in family activities (Williams 2008). In a recent review based on extensive literature search and expert knowledge Arlinghaus, Bohle, Iskra-Golex, Jansen, Jay and Rotenberg (2019) identified shift work not only as a primary risk factor for poor work-life balance, but also outlined its association with unfavorable family outcomes such as children's development and divorce.

Although research on this topic is emerging and there are several systematic reviews on shift work and health outcomes, to our knowledge no study so far has presented a systematic overview on the existing research on shift work and work-family conflict. Quantification of evidence regarding the relationship of shift work and work-family conflict seems to be missing so far. Thus, the meaning of shift work for work-family conflict can hardly be estimated. Systematic reviews provide a tool to compile scattered empirical findings systematically and evaluate them. Therefore, our aim is to evaluate the state of research on shift work and its association with work-to-family conflict (WFC) and family-to-work conflict (FWC) and to answer the following research question: *How does shift work relate to work-family conflict?* While Arlinghaus et al. (2019) took a broad approach and investigated the effects of shift work and non-standard working hours, such as long, irregular and unpredictable hours, on workers, their families and the community, we conduct a systematic review with a documented rigorous literature search,

to focus on the association of shift work, shift work types, and shift work characteristics with WFC and FWC. We thereby intend to validate the proposed path in the conceptual model by Tucker and Folkard (2012) linking work schedule features to disturbed family and social life. To do so, we performed a systematic literature review of empirical research articles in medical and psychological journals. In the following, we use *work-family conflict* as a term referring to the construct in general, but apply WFC respectively FWC if talking about a certain direction of the conflict. The investigation of shift work has a long tradition in disciplines such as industrial sciences, medical sciences and epidemiology, while the investigation of work-family conflict has a long tradition in psychology. We will now outline these two core concepts of our review as well as their proposed association.

## **Shift Work and Work-Family Conflict**

### *Shift work*

Intending to get an overview on the measurement of shift work, it has been recognized that shift work is an insufficiently defined construct in research (Barnes-Farrell et al. 2008), including a large variety of different work schedules. Costa (2016: 19) defines shift work as “any form of organization of work, different from the normal ‘daily work’, in which the operating time of a company is extended beyond the usual 8-9 h (typically between 07-08 a.m. and 05-06 p.m.), to cover the entire 24 h, through the alternation of different groups of workers”. Usually, shift workers share work stations that are alternately occupied (Costa 2016). Across research studies, the understanding of shift work and its operationalization vary strongly because in practice, shift schedules are very heterogeneous and come with different characteristics. It is not unusual to find a large number of different shift systems even within one organization. For instance, Totterdell (2005) defines shift work as work that starts or ends outside regular daytime working hours from Monday to Friday between 7 a.m. to 7 p.m. Or, Barnes-Farrell et al. (2008) refer to work conducted outside 9 a.m. and 5 p.m. Aside the position of working time, shift work differs in a large number of characteristics that affects workers’ well-being and health. Shift length can be short in case of part-time work and last to a maximum of twelve hours. Shift systems can be discontinuous, semi-continuous and continuous depending on whether shifts cover 24 hours of the day and/or seven days a week. Shift types include day, morning, evening, and/or night shifts. Within each shift type start and end times vary – possibly resulting in a large number of different shifts within one company. If it is a rotating shift system, direction of rotation (clockwise/phase-delayed; counter-clockwise/phase-advanced) and speed of rotation (fast/intermediate/slow) can be differentiated. For example, in a typical fast clockwise or forward rotation two morning shifts are followed by two evening shifts and it ends with two nights shifts. However, in some companies shift systems are characterized by irregular positions or lengths of shifts (Costa 2016). The changing working hours or their unpredictability may pose a challenge to the compatibility of work and family.

### *Work-family conflict*

As outlined above, difficulties in the compatibility of work and family have been summarized in the concept of work-family conflict. This is defined as “a form of interrole conflict in which the role pressures from the work and family domains are mutually incompatible in some respect. That is, participation in the work (family) role is made more difficult by virtue of participation in the family (work) role” (Greenhaus/Beutell 1985: 77). Obligations at work hinder the fulfilment of home and family roles and vice versa (Greenhaus/Beutell 1985; Carlson/Kacmar/Williams 2000). Obviously, there are more life domains than just these two, work and family – some employees do not even have family. Thus, interrole conflict can occur between other life domains, for example between paid and voluntary work, or between family and leisure activities. In the current review we include interrole conflicts of the work domain with different domains related to private life (e.g. family, home, leisure), but we do not include interrole conflicts that do not directly involve the work role.

At first, work-family conflict was studied unidirectionally by focusing on work roles interfering with private and family life (Carlson et al. 2000). For example, due to a change in shift schedule an employee is no longer able to pick her daughter up from swimming lessons. Nowadays both directions from work to family and from family to work are considered to account for family demands - also conflicting with demands at work. An example for FWC could be that an employee has to take care of his/her elderly mother and therefore cannot go on business trips or take part in work events during evenings.

Beyond the two directions, three forms of work-family conflict are differentiated in the literature: First, the time-based conflict that describes the lack of time to fulfil demands in one role due to the time, that has been spent on activities in another role and therefore is no longer available, as described in the examples above. Second, the strain-based conflict that refers to the case in which the strain in one role influences the performance in the other role. For example, an employee is so exhausted from his/her physically demanding job that he/she is too tired to visit the playground with his/her children after work. And third, the behaviour-based conflict that occurs if behaviour that is required in one role hinders the fulfilment of demands in another role (Greenhaus/Beutell 1985). In case of a man who is a feeling father but works as correctional officer and needs to be tough, self-confident and unemotional in this position. With regard to shift work, especially time-based work-family conflicts could play an important role.

### *The effect of shift work on work-family conflict*

Work schedule features can disturb the social and family life (Tucker/Folkard 2012). Shift work requires employees to work at times that are most socially valuable, such as evenings and weekends, during which most family and other social activities take place. In the traditional work-family conflict framework, shift work was already identified as a work demand that affects work-family conflict (Greenhaus/Beutell 1985). In their model of work-family role pressure incompatibility, Greenhaus and Beutell (1985) state that shift work may consume time that results in time-related role pressure incompatibility, that is work-family conflict. They also suggest that the time demands posed on employees for example through shift work may affect strain-related WFC. Thus, especially time-related WFC but also strain-related WFC may be affected by shift

work. Also, those shift work schedules or features that are very irregular, or cover a lot of socially valuable time should be more strongly related to WFC. Further, shift work may exert a stronger effect on work-family conflict for employees with more pressures from the home domain regarding time and strain, for example those with young children, those with an employed spouse or those who receive little support from their spouse (see Greenhaus/Beutell 1985).

Earlier meta-analyses on work demands and work-family conflict showed that antecedents from the work-domain can also be related to FWC (Michel/Kotrba/Mitchelson 2011). However, effects are smaller, and the authors found no effect for work time demands on FWC. In line with this, in their meta-analysis on flexible work arrangements and work-family interference, Allen, Johnson, Kiburz and Shockley (2013) found no significant relationship between flexible time arrangements and FWC, but a small effect on WFC. Moreover, Byron (2005) found a medium-sized effect of schedule flexibility on WFC and a small effect on FWC. The theory and these findings suggest that shift work is related to WFC and rather not to FWC. Thus, in this systematic review, in which we investigate the link between shift work as a special working time demand and work-family conflict, we expect to find significant relationships between shift work types and shift work characteristics with WFC but not with FWC.

## Method

Conducting this review, we largely followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines (Moher/Liberati/Tetzlaff/Altman/The Prisma Group 2009).

### *Search strategy*

The aim of the literature search was to identify and extract peer-reviewed scientific journal articles concerning the association of shift work and work-family conflict. As work-family conflict is a psychological construct, we used the psychological databases of EBSCO (Psycindex, PsycINFO, PsycARTICLES, E-Journals). Additionally, because shift work is often studied in medical or health contexts, we also conducted a literature search in PubMed. We limited our search to articles published in English language. The search was conducted by combining two groups of keywords<sup>2</sup>. The first group covers the keywords concerning shift work, combining *shift* and *schedul\**, *work*, *system\**, *rotat\**, *night*, *workday*, *work*, *hour\**, *evening*, *split* or *plan\**, *shiftwork\**, *night work*, *work schedul\**, *irregular working hours*, or *compressed work\* week\**. The second group includes the keywords assessing our outcome of interest, which is work-family conflict, combining *work\** with *family*, *home*, *leisure*, *life*, *nonwork*, *non-work* or *privat\** with *balance\**, *compatibility*, *conflict\**, *interact\**, *interf\**, *spillover* or *tension*. We chose this broad approach to ensure we detect as many studies possible investigating shift work and work-family conflict. The search was finalized on the 15th of May in 2017.

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<sup>2</sup> The complete search strings are available from the authors upon request.

### *Selection procedure*

The flow chart depicting the selection procedure is presented in Figure 1. First, duplicates and studies in any other language than English were removed from the search result. The review-process was conducted by all authors separately in a stepwise manner: as a first step, we identified relevant studies on shift work and work-family conflict by reading titles and abstracts. In case a decision could not be made based on title and abstract, full texts were screened to make sure not to miss a relevant study. As a second step, full texts of all selected study abstracts were extracted and read. For inclusion of a study, the following criteria had to be fulfilled: 1) empirical quantitative studies with cross-sectional or prospective longitudinal study design; 2) published in peer-reviewed journals; 3) published in English language since 1990 when research on work-family conflict began to emerge; 4) statistically testing the association of shift schedules or shift characteristics with work-family conflict; and 5) the construct work-family conflict was measured with a scale of at least two items to ensure psychometric quality. In case the studies did not use the term *work-family conflict*, or related expressions for the investigated construct, we looked at the items used to assess whether work-family conflict was measured or not.

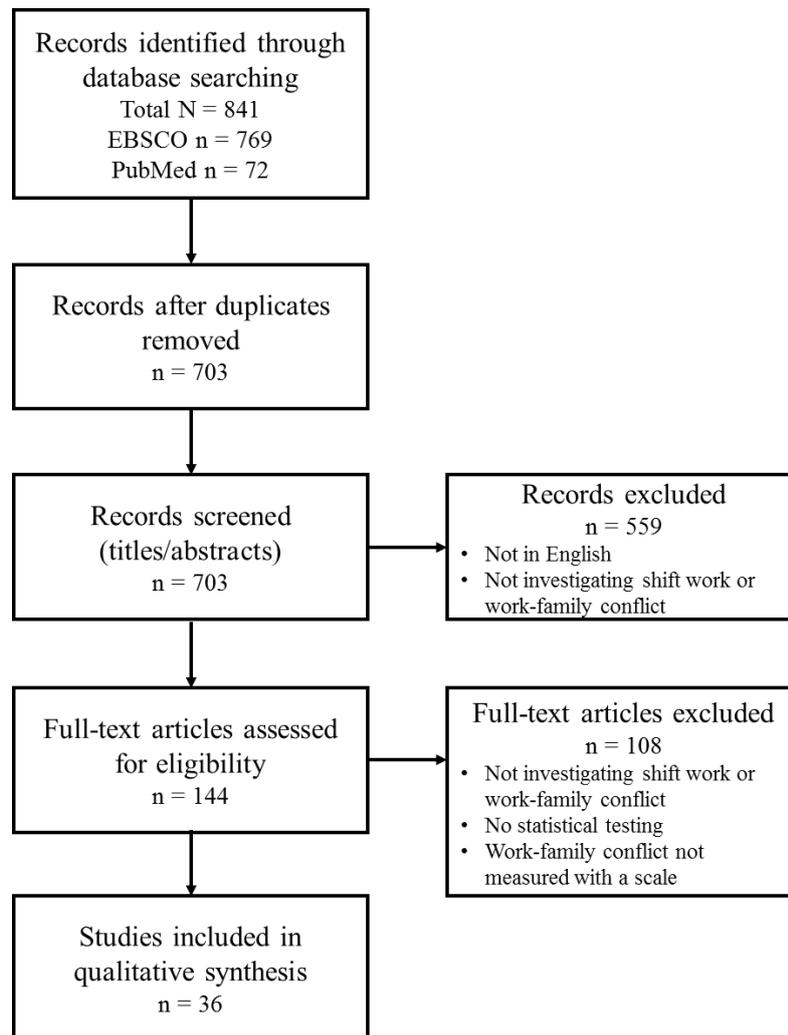
### *Analysis*

From the included studies, we extracted the following information: authors, year published, sample size, study design, study population, country and year of data collection (if mentioned), shift schedule, test statistics and effect estimates. If test statistics and regression analysis were performed, we extracted both. In case of several steps in the presented analysis, we extracted the univariate results and the final, fully adjusted results, but based our assessment on the univariate results. To enhance readability of the paper, we do not present the exact test statistics and effect estimates, but we present them classified into significant positive (+), significant negative (-) and not significant (ns) findings (see Tables 2 to 5).<sup>3</sup>

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<sup>3</sup> The exact extracted findings are available from the authors upon request.

Figure 1: Flow chart



## Results

Our systemic literature search identified 703 articles after duplicates were removed. Overall, 36 peer-reviewed journal articles were eligible and met our inclusion criteria and were therefore included in our review. The extracted studies are summarized in four categories that differ in terms of comparison groups:

- 1) studies comparing work-family conflict in shift workers (with the type of shift-work not defined in more detail) with employees working regular day work schedules, including fixed day shifts,
- 2) studies comparing work-family conflict in workers in specific shift schedules (e.g. evening, night or rotating shifts) with employees working a regular day work schedule,
- 3) studies comparing work-family conflict among shift workers in different shift schedules (e.g. evening, night or rotating shifts), and

- 4) studies investigating the association between shift characteristics (e.g. schedule control, schedule irregularity, weekend work, night work) and work-family conflict in a sample of shift workers. These are studies that test whether the presence of a certain characteristic is related to WFC, but they do not compare groups of workers with distinct shift types.

Although several studies with a longitudinal research design were identified, only one of the extracted studies included two measurement time points but reported only correlations (Pisarski/Babour 2014). All other studies reported test statistics and estimates were based on cross-sectional data. Most studies were conducted in the U.S. (n=14), followed by Australia (n=6). The largest study population included was nearly 26,000 (Estryn-Behar/Van der Heijden/NEXT Study Group 2012) and the smallest was 110 study participants (Barnett/Gareis/Brennan 2008).

### *Study populations*

The studies included in this review are based on a wide range of study populations. Table 1 gives an overview on the most relevant study information. In seven studies data from population-based samples of employees was applied to conduct analyses on work-family conflict (Tausig/Fenwick 2001; Grosswald 2003; Jansen/Kant/Nijhuis/Swaen/Kristensen 2004; Davis/Goodman/Piretti/Almeida 2008; Haines/Marchand/Rousseau/Demers 2008; Beutell 2010; Edgell/Ammons/Dahlin 2011, Schieman/Glavin 2011; Tuttle/Garr 2012). Health care workers, in particular nurses, were the most frequent studied group in research on shift work and work-family conflict (Barnes-Farrell et al. 2008; Barnett et al. 2008; Camerino/Sandri/Sartori/Conway/Campanini/Costa 2010; Dahlgren/Tucker/Gustavsson/Rudman 2016; Day/Chamberlain 2006; Estryn-Behar et al. 2012; Heponiemi/Kouvonen/Sinervo/Elovainio 2010; Kunst/Kvamme Løset/ Hosøy/Bjorvatn/Moen/Magerøy/Pallesen 2014; Lembrechts/Dekocker/Zanoni/Pulignano 2015, Mauno/Ruokolainen/Kinnunen 2015; Pisarski/Barbour 2014; Pisarski/Bohle/Callan 1998; Pisarski/Bohle/Callan 2002; Simunic/Gregov 2012; Spelten/Totterdell/Barton/Folkard 1995; Takeuchi/Yamazaki 2010; Yildirim/Aycan 2008). In addition studies focusing on economic branches or professions include police officers (Demerouti/Geurts/Bakker/Euwema 2004; Day/Chamberlain 2006); marketing and customer service operators (Bohle/Willaby/Quinlan/McNamara 2011); employees in software firms (Singh/Suar/Leiter 2012); employees in an information technology division (Crain/Hammer/Bodner/Kossek/Moen/Lilienthal/Buxton 2014); and maintenance workers in a transportation service (Iskra-Golec/Smith/Wilczek-Ruzyckzka/Siemiginowska/Watroba 2017).

The study populations did not only differ regarding the occupations of the participants, but also in terms of sociodemographic indicators. For example, in a number of studies, the focus was on married or cohabitating employees and employees with family and children (Grosswald 2003; Barnett et al. 2008; Davis et al. 2008; Takeuchi/Yamazaki 2010, Carlson/Grzywacz/Ferguson/Hunter/Clinch/Arcury 2011; Liu/Wang/Keesler/Schneider 2011; Odom/Vernon-Feagans/Crouter 2013; Cooklin/Giallo/Strazdins/Martin/Leach/Nicholson 2015; Tamelin/Malinen/Rönkä/Verhoef 2016). For instance, Grosswald (2003) studied work-family

conflict in wage employees with family extracting the data from a representative workforce sample, similar to Davis et al. (2008). Others put their emphasis on full-time working mothers (Carlson et al. 2011); paid employed fathers (Cooklin et al. 2015); cohabitating and married employees with children under the age of 18 years (Liu et al. 2011); African American families with young children (Odom et al. 2013); female nurses with children and/ or spouse (Takeuchi/Yamazaki 2010); or dual earning parents (Tammelin et al. 2016).

*Table 1: Study characteristics of included studies*

<b>Author (year)</b>	<b>Sample size</b>	<b>Population</b>
Barnes-Farrell, Davies-Schrils et al. (2008)	906	healthcare workers (Survey of Work and Time for Healthcare Workers/ Survey of Healthcare Professionals (SWAT- Healthcare), Australia, Brazil, Croatia and the United States)
Barnett, Gareis et al. (2008)	110 (55 couples)	dual earner families of female nurses at least 28 hours per week in 24-hour facility with full-time working husband and children, schedule for at least 1 year (2002-2004, USA)
Beutell (2010)	2,810	employees (National Study of the Changing Workforce (NSCW) 2002, USA)
Bohle, Willaby et al. (2011)	179	marketing and customer service operators (Australia)
Camerino, Sandri et al. (2010)	664	nurses (six health care institutions, Italy)
Carlson, Grzywacz et al. (2011)	179	working mothers (USA)
Cooklin, Giallo et al. (2015)	3,243	employed fathers with children aged 3-12 months (Longitudinal Study of Australian Children (LSAC), 2004/2005, Australia)
Crain, Hammer et al. (2014)	623	information technology workers (Work, Family and Health Network (WFHN), 2009-2010, USA)
Dahlgren, Tucker et al. (2016)	1,459	nursing students (national cohort of registered nurses graduated from Swedish nursing education in 2006, Longitudinal Analysis of Nursing Education/Entry in working life (LANE), 2006, Sweden)
Davis, Goodman et al. (2008)	1,166	married employees aged 25-74 (MIDUS National Survey, USA)
Day and Chamberlain (2006)	436	female police officers and female nurses (USA, Canada)
Demerouti, Geurts et al. (2004)	3,027	military police force (2000, Netherland)

Edgell, Ammons et al. (2011)	1,556	employees (National Survey of Religion and Family Life, (NSRFL), 2006, USA)
Estryn-Behar, Van der Heijden et al. (2012)	25,924	nurses (Nurses' Early Exit Study, 2002-2003, European Countries: Belgium, Finland, France, Germany, Great Britain; Italy, Netherlands, Poland, Slovakia, Sweden)
Grosswald (2003)	2,429	employees (National Study of the Changing Workforce (NSCW), 1999, USA)
Haines III, Marchand et al. (2008)	2,931	employees at least 20 h/ week, married/ cohabitating, at least one child in the household (Gender, Alcohol, and Culture: An International Study (GENACIS), 2004-2005, Canada)
Heponiemi, Kouvonen et al. (2010)	1,767	nurses (Finnish Health Care Professionals Study, 2006, Finland)
Iskra-Golec, Smith et al. (2017)	168	employees in public transportation service (Poland)
Jansen, Kant et al. (2004)	5,308	employees (Maastricht cohort study, 1998, Netherlands)
Kunst, Løset et al. (2014)	2,058	nurses (Survey of sleep, shift work and health (SUSSH), 2008/ 2009, Norway)
Lembrechts, Dekocker et al. (2015)	384	nurses with children or partner (2010, Belgium)
Liu, Wang et al. (2011)	2,346	married or cohabitating employees with at least one child under the age of 18 (National Study of the Changing Workforce (NSCW), 1997/ 2002, USA)
Mauno, Ruokolainen et al. (2015)	1,634	nurses (2009, Finland)
Odom, Vernon-Feagans et al. (2013)	231	African-American mothers (Family Life Project (FLP), 2003 -2004, USA)
Pisarski and Barbour (2014)	166	nurses in a medium sized, general hospital (Australia)
Pisarski, Bohle et al. (1998)	172	female nurses (Australia)
Pisarski, Bohle et al. (2002)	60	ambulance service workers (Australia)
Schieman and Glavin (2011)	2,544	employees (National Study of the Changing Work-force, 2002/ 2003, USA)
Simunic and Gregov (2012)	128	married nurses with at least one child (2008, Croatia)
Singh, Suar et al. (2012)	372	software developers (India)

Spelten, Totterdell et al. (1995)	510	nurses (England and Wales)
Takeuchi and Yamazaki (2010)	138	female nurses with children or partner (three hospitals, Japan: Tokyo, 2008)
Tammelin, Malinen et al. (2016)	1,000	dual earner parents with children aged 0-12 ("Families 24/7", 2012-2013, Britain, Finland, the Netherlands)
Tausig and Fenwick (2001)	2,958	Employees (National Study of the Changing Workforce, USA)
Tuttle and Garr (2012)	3,051	employees (National Study of the Changing Work-force, 2008, USA)
Yildirim and Aycan (2008)	243	female nurses (Turkey)

### *Comparison between shift work and regular day work*

Eleven studies investigated work-family conflict in shift workers and workers with a regular day schedule, including workers with fixed day shifts (see Table 2). Overall, shift work and working in non-standard schedules was associated with higher levels of WFC (Carlson et al. 2011; Crain et al. 2014; Edgell et al. 2011; Haines et al. 2008; Heponiemi et al. 2010; Jansen et al. 2004; Liu et al. 2011; Odom et al. 2013; Schieman/Glavin 2011; Tammelin et al. 2016; Tuttle/Garr 2012). Among these studies, only Tammelin et al. (2016) looked at different dimensions of WFC: time-based and strain-based conflict. They found that working non-standard schedules was related to higher time-based WFC, but not to strain-based WFC. Interestingly, Liu et al. (2011) differentiated in their investigation between cohabitating and married employees and only found a significant association between working non-standard work schedules and WFC among cohabitating employees.

While WFC was investigated in all eleven studies, FWC was only studied in two of the studies. The results show either no relation to shift work (Crain et al. 2014) or, if an association was found, it was weaker than the relationship between shift work and WFC (Edgell et al. 2011). Furthermore, Edgell et al. (2011) found that compared to standard working schedules, working in non-standard work schedules was related to a significant higher WFC among women and men. The increase in FWC was considerable smaller but also significant among women and men. In women, the presence of children under the age of 18 years was an important predictor of FWC but played no role for WFC in women and for men in general.

Table 2: Comparison between shift work and regular day work

	Study	WFC	FWC
Shift work	Carlson et al. 2011	+	<i>ns</i> +
	Crain et al. 2014	+	
	Edgell et al. 2011	+	
	Haines et al. 2008	+	
	Heponiemi et al. 2010	+	
	Jansen et al. 2004	+	
	Lui et al. 2011	+	
	Odom et al. 2013	+	
	Schieman & Glavin 2011	+	
	Tammelin et al. 2016	+	
	Tuttle & Garr 2012	+	

Note: + = significant positive; *ns* = not significant

### Comparison between different shift types and regular day work

#### Evening shifts

Three studies looking at the association between working evening shifts and WFC were identified (see Table 2; Grosswald 2003, Barnett et al. 2008; Beutell 2010). Two studies found evidence for greater WFC in workers with evening shifts (Barnett et al. 2008; Beutell 2010). Barnett et al. (2008) investigated the relationship of the work schedules of registered female nurses with their own WFC as well as with their husbands' WFC. They found that nurses working evening shifts with children and full-time employed husbands showed higher levels of WFC than their counterparts in day shifts. They found no association between the wives' work schedule and their husbands' WFC (Barnett et al. 2008). Further, Beutell (2010) investigated whether differences in FWC exist between employees in regular day work and evening shifts, but they found no indication.

#### Night shifts

Five studies present results concerning WFC in night shift workers compared to regular day workers. Overall, the majority of studies point to a higher WFC in night shift workers (Grosswald 2003; Davis et al. 2008; Beutell 2010; Kunst et al. 2014). Camerino et al. (2010) studied WFC in nurses and differentiated between nurses in regular day work, irregular day work, shift work without nights and shift work with nights. Nurses working shifts without night-shifts showed higher levels of WFC, while nurses in shift work, including night work had no statistically significant higher levels of WFC than day workers.

Davis et al. (2008) and Kunst et al. (2014) studied both directions of work-family conflict. Davis et al. (2008) found that night shift was related to both, a higher WFC and a higher FWC. Kunst et al. (2014) present diverging results concerning the two directions: night shift workers

showed higher levels of WFC compared to workers with a normal day schedule, but at the same time, these night workers showed a significantly lower level of FWC.

### Rotating shifts

The six identified studies concerning rotating shifts and work-family conflict do not draw a clear picture. We found an association between working in rotating shifts and higher levels of WFC compared to employees with regular work schedules in four studies (Grosswald 2003; Beutell 2010; Kunst et al. 2014; Mauno et al. 2015). Two studies found no differences between employees in rotating shifts and day work (Tausig/Fenwick 2001; Iskra-Golec et al. 2017). Kunst et al. (2014) and Mauno et al. (2015) compared two types of rotating shift models with day shift: whereas Kunst et al. (2014) found that working a rotating three shift model, including day, evening and night shifts, had a higher level of WFC than a rotating two shift model with day and evening shifts. Additionally, Mauno et al. (2015) reported a greater WFC among workers in a rotating two shift model than among workers working three rotating shifts. Beutell (2010), Iskra-Golec et al. (2017) and Kunst et al. (2014) studied both directions of work-family conflict but found no significant difference in FWC between workers in rotating shifts and regular day workers.

### Other schedules

Overall, six studies were extracted investigating other schedules than evening, night, or rotating shifts (see Table 3). Beutell (2010) and Grosswald (2003) looked at the association between flexible shifts, split shifts, and *other schedules*, and work-family conflict in reference to regular day work. Except for a higher level of WFC of employees working in *other schedules* in Beutell's (2010) study, no significant differences in WFC (Grosswald 2003; Beutell 2010) and FWC (Beutell 2010) in comparison to regular day work were found. Other schedules that have been studied are day work with irregular hours (Camerino et al. 2010), which was related to higher WFC compared to regular day work; weekend shift (Davis et al. 2008), which was unrelated to both WFC and FWC; day and evening shift (Kunst et al. 2014), which was related to higher WFC but not to FWC, as well as non-day shifts and non-Monday-Friday shifts (Tausig/Fenwick 2001), with the latter being related to higher WFC.

Table 3: Comparison between different shift types and regular day work

Shift type	Study	WFC	FWC
Evening shifts	Barnett et al. 2008	+	<i>ns</i>
	Beutell 2010	+	
	Grosswald 2003	<i>ns</i>	
Rotating shifts	Beutell 2010	+	<i>ns</i>
	Demerouti et al. 2004	<i>ns</i>	<i>ns</i>
	Grosswald 2003	+	
	Iskra-Golec et al. 2017	<i>ns</i>	<i>ns</i>

	Heponiemi et al. 2010 Kunst et al. 2014 Mauno et al. 2015 Tausig & Fenwick 2001	+ + + +	<i>ns</i>
Night shifts	Beutell 2010 Camerino et al. 2010 Cooklin et al. 2015 Davis et al. 2008 Grosswald 2003 Kunst et al. 2014 Lembrechts et al. 2015 Pisarski et al. 2014 Takeuchi & Yamazaki 2010	+ + + + + + + + <i>ns</i>	<i>ns</i>   +  -
Split shifts	Beutell 2010 Grosswald 2003	<i>ns</i> +	<i>ns</i> <i>ns</i>
Flexible shifts	Beutell 2010	<i>ns</i>	<i>ns</i>
Irregular day work	Camerino et al. 2010	+	<i>ns</i>
Weekend shifts	Davis et al. 2008	<i>ns</i>	<i>ns</i>
Day and evening shifts	Kunst et al. 2014	+	<i>ns</i>
Non-day shifts	Tausig & Fenwick 2001	<i>ns</i>	
Non Monday-Friday	Tausig & Fenwick 2001	+	

Note: + = significant positive; - = significant negative; *ns* = not significant

### Comparison of different shift types

Seven studies were found that examined work-family conflict comparing different shift types (see Table 4). In two studies, authors compared a large variety of different shift schedules with one another (Beutell 2010; Simunic/Gregov 2012): Beutell (2010) found no differences in WFC and FWC between regular evening shift, regular night shift, rotating shift, split shift, flexible or variable schedules and *other schedules*. The only exception is a significant difference in WFC between regular evening shifts and working in *other schedules*. Simunic and Gregov (2012) conducted a comparison between morning shifts, forward-rotating 12-hour shifts, forward rotating

8-hour shifts, and backward rotating plus irregular 8-hour shifts. The authors report a significant difference for WFC, but no differences in FWC. Highest WFC was observed among backward rotating plus irregular 8-hour shifts, followed by forward rotating 8-hour shifts and then by forward-rotating 12-hour shifts. The lowest value was found among morning shift workers.

Another study that stands out is the work by Estryn-Behar et al. (2012). The authors compared WFC in nurses in a part-time work schedule with 8-hour day shift, 10-hour day shift, 12-hour day shift, 8-hour night shift, 10-hour night shift, 12-hour night shift, alternating shifts with less than 6 nights per month, and alternating shifts with 6 or more nights per month. The authors found no differences in WFC between the work schedules (Estryn-Behar et al. 2012).

Other studies compared two different shift schedules with each other. Davis et al. (2008) compared weekend shifts with night shifts and found higher WFC and FWC to be associated with night shifts. Mauno et al. (2015) compared two rotating day shifts with three rotating shifts and found higher WFC in the three-shift system. Pisarski and Barbour (2014) compared rotating day shifts with rotating shifts with nights and found three shift work to be related to higher WFC in cross-sectional but not in longitudinal analysis. Finally, Spelten et al. (1995) compared rotating shifts with permanent night shifts and found higher WFC in the latter.

Table 4: Comparison of different shift types

Shift types	Study	WFC	FWC
(1) evening shift, (2) night shift, (3) rotating shift, (4) split shift, (5) flexible shifts, (6) other schedules	Beutell 2010	1 < 6 all others <i>ns</i>	all <i>ns</i>
weekend shift (ref.) versus night shift	Davis et al. 2008	+	+
part-time work (ref.) versus day shift 8 h, day shift 10 h, day shift 12h, night shift 8 h, night shift 10h, night shift 12h, alternating shifts < 6 nights/ month, alternating shifts ≥ 6 nights / month	Estryn-Behar et al. 2012	all <i>ns</i>	
(1) rotating shifts without night work versus (2) rotating shifts with night work	Mauno et al. 2015	1 > 2	

rotating shift without nights (ref.) versus rotating shift with nights	Pisarki et al. 2014	+	
(1) fixed morning shift versus (2) forward rotating two shift versus (3) forward rotating three shift versus (4) backward rotating irregular three shift	Simunic & Gregov 2012	1 < 2 < 3 < 4	ns
(1) rotating shift versus (2) permanent night shift	Spelten et al. 1995	1 > 2	

Note: + = significant positive; ns = not significant

### Shift work characteristics

A large number of studies focused on the association between shift work characteristics and work-family conflict in shift working populations (see Table 5). These studies do not compare shift types, but are testing whether shift work fulfills a certain characteristic, for instance that the schedule is fixed or includes night work, is related to a higher WFC or not. The most common studied shift characteristic was schedule control. Six studies found that control of work schedule was related to a lower work-family conflict, as shown by the work of Beutell (2010), Bohle et al. 2011, Pisarski and Barbour (2014), Schieman and Glavin (2011), Pisarki et al. (1998), and Tuttle and Garr (2012). Although the latter found a significant association of schedule control and WFC, the similar construct *flexible schedule options* was not related to WFC. Beutell (2010) found work schedule control to be negatively associated with WFC and FWC, although the association was stronger for WFC than for FWC. Four other studies did not find this association between work schedule control and work-family conflict (Pisarski et al. 2002; Carlson et al. 2011; Lembrechts et al. 2015; Tausig/Fenwick 2000). Here, the correlation was not significant, but in the adjusted model schedule control was negatively related to work-family conflict).

Most studies examining variability or irregularity in work schedules find an association with a higher degree of WFC (Day/Chamberlain 2006; Yildirim/Aycan 2008; Singh et al. 2012). However, Lembrechts et al. (2015) did not find significantly higher levels of WFC among workers reporting irregular or variable shifts. Furthermore, Bohle et al. (2011) found no association between the variability of working hours and WFC.

Another characteristic that has been studied more frequently is weekend or Sunday work (Barnes-Farrell et al. 2008; Camerino et al. 2010; Estryn-Behar et al. 2012; Lembrechts et al. 2015), which was related to higher WFC in most studies.

Night shifts as a shift work characteristic have been investigated in several studies with regard to work-family conflict. However, results on night shift duty are mixed. While Takeuchi and Yamazaki (2010) and Lembrechts et al. (2015) find no association, Cooklin et al. (2015) find a positive and significant correlation with WFC.

Further, for other shift work characteristics, higher levels of WFC were identified, including getting up before 5 o'clock (Camerino et al. 2010; Estryn-Behar et al. 2012), higher number of night shifts (Dahlgren et al. 2016), higher number of quick returns to work (Dahlgren et al. 2016); non-day versus day (Demerouti et al. 2004), shift takeover at short notice (Estryn-Behar et al. 2012), dissatisfaction with shift handover (Estryn-Behar et al. 2012), split shifts (Estryn-Behar et al. 2012), and changes in working schedules (Tammelin et al. 2016). The following shift characteristics were not significantly related to WFC: shift length (Barnes-Farrell et al. 2008); and rotating versus non-rotating (Demerouti et al. 2004). Finally, although not a characteristic of the schedule per se, satisfaction with one's work schedule was considered as a characteristic of shift work and studied in relation to work-family conflict. A high satisfaction with the shift schedule promotes a lower work-family conflict (Beutell 2010; Bohle et al. 2011; Mauno et al. 2015).

With regard to FWC Beutell (2010) and Demerouti et al. (2004) studied the association with schedule control, schedule satisfaction (Beutell 2010), non-day shift, and rotating shift (Demerouti et al. 2004). Higher schedule control and satisfaction were related to lower FWC (Beutell 2010).

Table 5: Shift work characteristics

Shift characteristic	Study	WFC	FWC
Schedule control	Beutell 2010	-	-
	Bohle et al. 2011	-	
	Carlson et al. 2011	<i>ns</i>	
	Lembrechts et al. 2015	<i>ns</i>	
	Pisarski et al. 1998	<i>ns</i>	
	Pisarski et al. 2002	-	
	Pisarski et al. 2014	-	
	Schieman et al. 2011	-	
	Tausig & Fenwick 2001	<i>ns</i>	
	Tuttle & Garr 2012	-	
Variability of shifts	Bohle et al. 2011	<i>ns</i>	
	Day et al. 2006	+	
	Lembrechts et al. 2015	<i>ns</i>	
	Singh et al. 2012	+	
	Tammelin et al. 2016	+	
	Tuttle & Garr 2012	<i>ns</i>	
	Yildirim & Aycan 2008	+	
Weekend work	Barnes-Farrell et al. 2008	+	
	Camerino et al. 2010	+	
	Estryn-Behar et al. 2012	+	
	Lembrechts et al. 2015	<i>ns</i>	
Night shift	Cooklin et al.	+	
	Lembrechts et al. 2015	<i>ns</i>	

	Takeuchi & Yamazaki 2010	<i>ns</i>	
Getting up before 5 o'clock	Camerino et al. 2010 Estryn-Behar et al. 2012	<i>ns</i> +	
Number of night shifts	Dahlgren et al. 2016	+	
Number of quick returns	Dahlgren et al. 2016	+	
Non-day vs. day	Demerouti et al. 2004	+	<i>ns</i>
Shift take-over at short notice	Estryn-Behar et al. 2012	+	
Split shifts	Estryn-Behar et al. 2012	+	
Shift length	Barnes-Farrell et al. 2008	<i>ns</i>	
Rotating versus non-rotating	Demerouti et al. 2004	<i>ns</i>	<i>ns</i>
Satisfaction with one's work schedule	Beutell 2010 Bohle et al. 2011 Mauno et al. 2015	- - -	-
Dissatisfaction with shift handover	Estryn-Behar et al. 2012	+	

Note: + = significant positive; - = significant negative; *ns* = not significant

## Discussion

Shift work – the deviation from a standard working time schedule – disturbs family and private life. A disturbed family and social life and can operate as a mechanism linking shift work to adverse health outcomes, as proposed in the conceptual framework by Tucker and Folkard (2012). The aim of the present study was to answer the research question “How does shift work relate to work-family conflict?” and to present the state of research on the relationship between shift work and the disturbance of family and private life by conducting a systematic literature review on shift work and work-family conflict. In line with our general hypotheses, our review clearly shows that employees working in shifts compared to those with regular day work experience more WFC. However, only one study looked at different dimensions of work-family conflict (Tammelin et al. 2016). In accordance with the argumentation by Barnes-Farrell et al. (2008), the authors find shift work to be associated with higher time-based WFC but not with strain-based WFC.

Furthermore, working in certain shift types – compared to regular day work – was related to higher WFC. Especially working night shifts, rotating shifts and evening shifts was associated with higher WFC in most studies. Studies comparing different shift types with each other regarding WFC did not reveal a clear overall pattern in identifying shifts that are better or worse regarding WFC. Regarding specific characteristics of shift work, most studies showed that weekend work was related to higher WFC. In addition, more than half of the studies that investigated schedule control and variability of shifts found significant associations with WFC. All other shift types or shift characteristics had only been studied in one or two studies. These are reported, but they do not allow for an integration for recommendations.

Although not all studies find significant relationships between the investigated aspects of shift and WFC, contradictory findings are scarce. If there was no association at all between shift work and work-family conflict, it can be assumed that more studies would have reported contradictory results. Furthermore, shift work outcomes are not only dependent on the shift system, but also on many other factors, such as for instance schedule control. These effects cannot be ruled out entirely in field studies, thus completely uniform findings cannot be expected. In this light, the relative consistent findings, based on numerous studies regarding shift work in general and shift work types, such as night shifts, are even more convincing.

Overall, the findings on the relationship of shift work and work-family conflict largely correspond to what is already well-known about the health correlates of shift work. Several studies have shown that work-family conflict can act as a mediator in the relationship between shift work and health (e.g. Fein/Skinner 2015; Haines et al. 2008; Wirtz/Nachreiner 2010). Similar to findings regarding shift work and health, findings regarding shift work and work-family conflict are heterogeneous, because they can depend on different factors, such as the different features of the shift and systems, or the samples and groups that are compared to each other in the studies. However, in concordance with findings regarding shift work and health, shift work can overall be regarded rather disadvantageous with respect to work-family conflict. This is also true for certain types of shift work, such as night shift work and working in rotating shifts, which are unfavorable compared to regular day work (e.g. Moreno/Marqueze/Sargent/Wright/Ferguson/Tucker 2019, Tucker/Folkard 2012).

Although there is a broad consensus about the bidirectionality of the construct of work-family conflict among the studies concerning shift work and work-family conflict, just a few studies investigated not only WFC but also FWC. In line with our general hypothesis on FWC, this systematic review confirmed that FWC is largely unrelated to shift work, or to specific shift types and shift characteristics. Several mechanisms could be the reason for this lack of relationship. On the one hand, employees may rather step back in their family and/or private life to meet the time-related demands posed upon them through their shift schedule. On the other hand, employees with family and/or private demands conflicting with their work schedule, might have left shift work or specific shift schedules.

### *Limitations and future research*

To our knowledge, this is the first work assessing the state of research on shift work and work-family conflict by performing a systematic literature review. Especially among shift workers, the compatibility of work and private life is challenging and crucial for health, as this has been proposed as one of the major mechanisms linking working time to health (Tucker/Folkard 2012). However, some limitations of this review have to be acknowledged.

Research on shift work and work-family conflict is heterogeneous with regard to the study populations, in particular among comparison groups, the occupations under study, regarding subgroups, and the definition of shift work and the definition and measurement of work-family conflict. This heterogeneity has several implications for our review. Due to the large variety of instruments assessing work-family conflict and different shift schedules studied, it was not possible to perform a meta-analysis to extract pooled estimates to quantify the importance of shift

work for the work-family conflict. Further, the conclusions or implications drawn from the literature can only be on a general level. In future studies, the definition of shift work should be clear and carefully selected. Doing so might contribute to more specific recommendations. Also, future research should investigate which groups are most vulnerable for which shift characteristics to affect work-family conflict. For example, one could argue that shift work may exert a stronger effect on work-family conflict for employees with more pressures from the home domain regarding time and strain, for example those with young children, with an employed spouse or with little support from their spouse (cf., Greenhaus/Beutell 1985).

Another limitation of this review is related to the quality of the included studies. In general, observational studies – which all included studies are – can provide only low evidence (Guyatt/Oxman/Kunz/Vist/Falck-Ytter/Schünemann/GRADE Working Group 2008). In addition, all but one studies included in this review relied on cross-sectional data. Thus, the reported findings reflect only associations but no causal relationships. It is reasonable to assume that one's working time arrangements affect the compatibility or conflict between work and private life. However, high WFC and high FWC may also have led employees to leave their shift system, shift type or shift work completely, such as it is known that employees do this due to health problems (Frese/Semmer 1986). Indeed, there is some evidence from a prospective study for this reverse relationship (Jansen/Mohren/van Amelsvoort/Janssen/Kant 2010): Work-family conflict was related to an increased risk to change from a three-shift system into day work. The *healthy worker effect* describes that leaving shift work due to ill health results in a higher share of workers with better health remaining in shift work. Thus, the effects presented in the studies may underestimate the actual effect of shift work on work-family conflict. Future research, we argue, should therefore explore the causal links between shift work and work-family conflict in prospective and/or intervention studies. As shift work is often inevitable, future research should take a stronger resource-based view for the design of shift schedules. For example, more attention should be paid to how shiftwork characteristics, such as schedule control and predictability of working time, could provide resources with the potential to reduce work-family conflict for employees. Furthermore, it is not sufficient to focus on shift systems only, but future research should rather take a more holistic view and investigate overall constellations of shift work, job demands and job resources when investigating effects of shift work. For example, the statistical method of latent class analyses to determine types of shift workers could provide a useful tool in this context (e.g. Brauner/Frank/Wöhrmann/Michel 2019). It is known that several groups of shift workers are exposed to many additional job-demands (e.g. Fischer/Silva-Costa/Griep/Smolensky/Bohle/Rotenberg 2019), whereas the job demands of others are reduced (e.g. for night shift workers). In doing so, the role of work-family conflict in the relationship of shift work and other working conditions with health outcomes should receive more attention: On the one hand, it is known that work-family conflict is associated with ill physical and mental health (Amstad/Meier/Fasel/Elfering/Semmer 2011), on the other hand, there is some evidence that this relationship is even stronger in shift workers (Elfering/Igic/Keller/Meier/Semmer 2016).

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### *Practical implications*

Although this systematic review as well as the studies included in the review have several limitations, the overview on the relationship of shift work, shift types, and shift characteristics with work-family conflict reveals practical implications. A general – and not surprising – recommendation that can be drawn from this review is that shift work should be avoided whenever possible, because it is related to a higher WFC, which in turn can contribute to a decline in employee health. Working evenings, nights, rotating schedules, and weekends covers social valuable time. Parents want to see their children in the evenings, and friends often meet on Friday or Saturday evenings. Thus, shift schedules should be designed in a way that all employees have a sufficient number of work-free weekends and evenings/nights – especially on the weekend. Another aspect in the design of shift work that contributes to employees' work-family conflict is the predictability and variability of shift times. Irregular shift schedules and changes in the shift schedule make it difficult or even impossible for employees to plan their family and/or free time. Private appointments and meetings cannot be arranged in advance, or they often must be cancelled, which might result in a loss of social contacts. Thus, shift schedule planning should be made with sufficient time ahead, in order to ensure long-term planning security for the employees. Further, giving employees some control over their work schedule offers possibilities to better align work and family as well as other aspects of private life.

Finally, all these measures can help to ensure that employees are as satisfied with their work schedule as possible, which leads to fewer work-family conflict. While measures taken to prevent WFC might be especially important for parents, employees without children should not be disadvantaged, as a social network and support from friends are important agents with regard to employee health.

### **Conclusion**

In conclusion, shift work is a risk factor for an increased WFC. Different aspects of shift work seem to contribute to this. Shift work occupies social valuable time (e.g. weekend work, evening shifts) and irregular shifts – especially if they are often subject to change and therefore unpredictable – can potentiate this. Although this review does not allow a quantification of which shift schedule features are most detrimental for employees' family and private lives, some recommendations regarding shift design can be made, which are in line with previous recommendations on shift work design, for example the importance of work-free weekends and the predictability of shift times. Future research should especially focus on the investigation of work-family conflict in overall constellations of shift work and other working conditions.

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### References

- Allen, Tammy D., David E. L. Herst, Carly S. Bruck and Martha Sutton (2000). Consequences associated with work-to-family conflict: A review and agenda for future research. *Journal of Occupational Health Psychology*, 5(2), 278-308.
- Allen, Tammy D., Ryan C. Johnson, Kaitlin M. Kiburz and Kristen M. Shockley (2013). Work-family conflict and flexible work arrangements: Deconstructing flexibility. *Personnel Psychology*, 66(2), 345-376.
- Amstad, Fabienne T., Laurenz L. Meier, Ursula Fasel, Achim Elfering, and Norbert K. Semmer (2011). A meta-analysis of work-family conflict and various outcomes with a special emphasis on cross-domain versus matching-domain relations. *Journal of Occupational Health Psychology*, 16(2), 151-169.
- Arlinghaus, Anna, Philip Bohle, Irena Iskra-Golec, Nicole Jansen, Sarah Jay, and Lucia Rotenberg (2019). Working time society consensus statements: evidence-based effects of shift work and non-standard working hours on workers, family and community. *Industrial Health* 57(2), 184-200.
- Barnes-Farrell, Janet L., Kimberly Davies-Schrills, Alyssa McGonagle, Benjamin Walsh, Lee Di Milia, Frida Marina Fischer, Barbara B. Hobbs, Ljiljana Kaliterna and Donald Tepas(2008). What aspects of shiftwork influence off-shift well-being of healthcare workers? *Applied Ergonomics*, 39(5), 589-596.
- Barnett, Rosalind C., Karen C. Gareis and Robert T. Brennan (2008). Wives' shift work schedules and husbands' and wives' well-being in dual-earner couples with children. *Journal of Family Issues*, 29(3), 396-422.
- Beutell, Nicholas J. (2010). Work schedule, work schedule control and satisfaction in relation to work-family conflict, work-family synergy, and domain satisfaction. *Career Development International*, 15(5), 501-518.
- Bianchi, Suzanne M. and Melissa A. Milkie (2010). Work and family research in the first decade of the 21st century. *Journal of Marriage and Family*, 72(3), 705-725.
- Bohle, Philip, Harold Willaby, Michael Quinlan and Maria McNamara, M. (2011). Flexible work in call centres: Working hours, work-life conflict & health. *Applied Ergonomics*, 42(2), 219-224.
- Brauner, Corinna, Kilian Frank, Anne M. Wöhrmann and Alexandra Michel (2019). Health and work-life balance across types of work schedules: A latent class analysis. *Applied Ergonomics*, 81, advance online publication.

- Byron, Kristin (2005). A meta-analytic review of work-family conflict and its antecedents. *Journal of Vocational Behavior*, 67(2), 169-198.
- Camerino, Donatella, Marco Sandri, Samantha Sartori, Paul M. Conway, Paolo Campanini and Giovanni Costa (2010). Shiftwork, work-family conflict among Italian nurses, and prevention efficacy. *Chronobiology International*, 27(5), 1105-1123.
- Carlson, Dawn S., K. Michele Kacmar and Larry J. Williams (2000). Construction and initial validation of a multidimensional measure of work-family conflict. *Journal of Vocational Behavior*, 56(2), 249-276.
- Carlson, Dawn S., Joseph G. Grzywacz, Merideth Ferguson, Emily M. Hunter, C. Randall Clinch and Thomas A. Arcury (2011). Health and turnover of working mothers after childbirth via the work-family interface: An analysis across time. *Journal of Applied Psychology*, 96(5), 1045-1054.
- Cooklin, Amanda R., Rebecca Giallo, Lyndall Strazdins, Angela Martin, Liana S. Leach, L. and Jan M. Nicholson (2015). What matters for working fathers? Job characteristics, work-family conflict and enrichment, and fathers' postpartum mental health in an Australian cohort. *Social Science & Medicine*, 146, 214-222.
- Costa, Giovanni (2003). Shift work and occupational medicine: An overview. *Occupational Medicine*, 53(2), 83-88.
- Crain, Tori L, Leslie B. Hammer, Todd Bodner, Ellen Ernst Kossek, Phyllis Moen, Richard Lilienthal and Orfeu M. Buxton (2014). Work-family conflict, family-supportive supervisor behaviors (FSSB), and sleep outcomes. *Journal of Occupational Health Psychology*, 19(2), 155-167.
- Dahlgren, Anna, Philip Tucker, Petter Gustavsson and Ann Rudman (2016). Quick returns and night work as predictors of sleep quality, fatigue, work-family balance and satisfaction with work hours. *Chronobiology International*, 33(6), 759-767.
- Davis, Kelly D., W. Benjamin Goodman, Amy E. Pirretti and David M. Almeida (2008). Nonstandard work schedules, perceived family well-being, and daily stressors. *Journal of Marriage and Family*, 70(4), 991-1003.
- Day, Arla L. and Trina C. Chamberlain (2006). Committing to your work, spouse, and children: Implications for work-family conflict. *Journal of Vocational Behavior*, 68(1), 116-130.
- Demerouti, Evangelia, Sabine A. Geurts, Arnold B. Bakker and Martin Euwema (2004). The impact of shiftwork on work-home conflict, job attitudes and health. *Ergonomics*, 47(9), 987-1002.
- Edgell, Penny, Samantha K. Ammons and Eric C. Dahlin (2011). Making Ends Meet. *Journal of Family Issues*, 33(8), 999-1026.
- Elfering, Achim, Ivana Igic, Anita Keller, Laurenz L. Meier and Norbert K. Semmer (2016). Work-privacy conflict and musculoskeletal pain: A population-based test of a stress-sleep-mediation model. *Health Psychology and Behavioral Medicine*, 4(1), 70-90.
- Estryn-Behar, Madeleine, Beatrice I. Van der Heijden and NEXT Study Group (2012). Effects of extended work shifts on employee fatigue, health, satisfaction, work/family balance, and patient safety. *Work*, 41 Suppl 1, 4283-4290.
- Eurofound (2017). *Sixth European Working Conditions Survey – Overview report (2017 update)*. Luxembourg: Publications Office of the European Union

- Fein, Erich C. and Natalie Skinner (2015) Clarifying the effect of work hours on health through work-life conflict. *Asia Pacific Journal of Human Resources*, 53(4), 448-470.
- Fischer, Frida M., Aline Silva-Costa, Rosane H. Griep, Michael H. Smolensky, Philip Bohle, and Lucia Rotenberg (2019). Working Time Society consensus statements: Psychosocial stressors relevant to the health and wellbeing of night and shift workers. *Industrial Health*, 57(2), 175-183.
- Frese, Michael and Norbert K. Semmer (1986). Shiftwork, stress, and psychosomatic complaints: A comparison between workers in different shiftwork schedules, non-shiftworkers, and former shiftworkers. *Ergonomics*, 19, 99-114.
- Greenhaus, Jeffrey H and Nicholas J. Beutell (1985). Sources of conflict between work and family roles. *Academy of Management Review*, 10(1), 76-88.
- Grosswald, Blanche(2003). Shift Work and Negative Work-to-Family Spillover. *Journal of Sociology and Social Welfare*, 15(4), 31-56.
- Guyatt, Gordon H., Andrew D. Oxman, Regina Kunz, Gunn E. Vist, Yngve Falck-Ytter, Holger J. Schünemann and GRADE Working Group (2008). What is "quality of evidence" and why is it important to clinicians?. *British Medical Journal (Clinical research ed.)*, 336(7651), 995-998.
- Haines III, Victor Y., Alain Marchand, Vincent Rousseau and Andrée Demers (2008). The mediating role of work-to-family conflict in the relationship between shiftwork and depression. *Work & Stress*, 22(4), 341-356.
- Hämmig, Oliver, Felix Gutzwiller and Georg Bauer (2009). Work-life conflict and associations with work- and nonwork-related factors and with physical and mental health outcomes: A nationally representative cross-sectional study in Switzerland. *BMC Public Health*, 9(1), 435.
- Heponiemi, Tarja, Anne Kouvonen, Timo Sinervo and Marko Elovainio (2010). Do psychosocial factors moderate the association of fixed-term employment with work interference with family and sleeping problems in registered nurses: A cross-sectional questionnaire survey. *International Journal of Nursing Studies*, 47(9), 1096-1104.
- Iskra-Golec, Irena, Lawrence Smith, Ewa Wilczek-Ruzyczka, Patrycja Siemiginowska and Joanna Watroba (2017). Shift schedule, work-family relationships, marital communication, job satisfaction and health among transport service shift workers. *International Journal of Occupational Medicine and Environmental Health*, 30(1), 121-131.
- Jansen, Nicole W. H., Ijmert Kant, Frans J. N. Nijhuis, Gerard M. H. Swaen and Tage S. Kristensen (2004). Impact of worktime arrangements on work-home interference among Dutch employees. *Scandinavian Journal of Work, Environment & Health*, 30(2), 139-148.
- Jansen, Nicole W. H., Danielle C. L. Mohren, Ludovic G. P. M. van Amelsvoort, Nathalie Janssen and Ijmert Kant (2010). Changes in working time arrangements over time as a consequence of work-family conflict. *Chronobiology International*, 27(5), 1045-1061.
- Knutsson, Anders (2003). Health disorders of shift workers. *Occupational Medicine*, 53(2), 103-108.
- Kunst, J. Rønningsdalen, Gøril K. Løset, Daniel Hosøy, Bjørn Bjorvatn, Bente E. Moen, Nils Magerøy and Ståle Pallesen (2014). The relationship between shift work schedules and spillover in a sample of nurses. *International Journal of Occupational Safety and Ergonomics*, 20(1), 139-147.
- Lembrechts, Lieve, Vickie Dekocker, Patrizia Zanoni and Valeria Pulignano (2015). A study of the determinants of work-to-family conflict among hospital nurses in Belgium. *Journal of Nursing Management*, 23(7), 898-909.

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- Liu, Hui, Qiu Wang, Venessa Keesler and Barbara Schneider (2011). Non-standard work schedules, work–family conflict and parental well-being: A comparison of married and cohabiting unions. *Social Science Research*, 40(2), 473-484.
- Mauno, Saija, Mervi Ruokolainen, Ulla Kinnunen (2015). Work-family conflict and enrichment from the perspective of psychosocial resources: comparing Finnish healthcare workers by working schedules. *Applied Ergonomics*, 48, 86-94.
- McMenamin, Terence M. (2007). A time to work: Recent trends in shift work and flexible schedules. *Monthly Labor Review* 130(12), 3-15.
- Michel, Jesse S., Lindsey M. Kotrba, Jacqueline K. Mitchelson, Malissa A. Clark and Boris Baltes (2011). Antecedents of work–family conflict: A meta-analytic review. *Journal of Organizational Behavior*, 32(5), 689-725.
- Moher, David, Alessandro Liberati, Jennifer Tetzlaff, Douglas G. Altman and The Prisma Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA Statement. *PLOS Medicine*, 6(7), e1000097.
- Moreno, Claudia R., Elaine C. Marqueze, Charli Sargent, Kenneth P. Wright, Sally A. Ferguson and Philip Tucker (2019). Working Time Society consensus statements: Evidence-based effects of shift work on physical and mental health. *Industrial Health*, 57(2), 139-157.
- Odom, Erika C., Lynne Vernon-Feagans and Ann C. Crouter (2013). Nonstandard maternal work schedules: Implications for African American children's early language outcomes. *Early Childhood Research Quarterly*, 28(2), 379-387.
- Pisarski, Anne, Philip Bohle and Victor J. Callan (1998). Effects of coping strategies, social support and work-nonwork conflict on shift worker's health. *Scandinavian Journal of Work, Environment & Health*, 24(3), 141-145.
- Pisarski, Anne, Philip Bohle and Victor J. Callan (2002). Extended shifts in ambulance work: Influences on health. *Stress and Health*, 18(3), 119-126.
- Pisarski, Anne, Christine Brook, Philip Bohle, Cynthia Gallois, Bernadette Watson, B. and Sarah Winch (2006). Extending a model of shift-work tolerance. *Chronobiology International*, 23(6), 1363-1377.
- Pisarski, Anne, Sandra A. Lawrence, Philip Bohle and Christine Brook (2008). Organizational influences on the work life conflict and health of shiftworkers. *Applied Ergonomics*, 39(5), 580-588.
- Schieman, Scott and Paul Glavin (2011). Education and work-family conflict: Explanations, contingencies and mental health consequences. *Social Forces*, 89(4), 1341-1362.
- Simunic, Ana and Ljiljana Gregov (2012). Conflict between work and family roles and satisfaction among nurses in different shift systems in Croatia: A questionnaire survey. *Archives of Industrial Hygiene and Toxicology*, 63(2), 189-197.
- Singh, Pankaj, Damodar Suar and Michael P. Leiter (2012). Antecedents, work-related consequences, and buffers of job burnout among Indian software developers. *Journal of Leadership & Organizational Studies*, 19(1), 83-104.
- Smith, Lawrence and Simon Folkard (1993). The impact of shiftwork on personnel at a nuclear power plant: An exploratory survey study. *Work & Stress*, 7(4), 341-350.
- Spelten, Evelien, Peter Totterdell, Jane Barton and Simon Folkard (1995). Effects of age and domestic commitment on the sleep and alertness of female shiftworkers. *Work & Stress*, 9(2-3), 165-175.

- Takeuchi, Tomoko and Yoshihiko Yamazaki (2010). Relationship between work-family conflict and a sense of coherence among Japanese registered nurses. *Japan Journal of Nursing Science*, 7(2), 158-168.
- Tammelinn, Mia, Kaisa Malinen, Anna Rönkä and Melissa Verhoef (2016). Work schedules and work-family conflict among dual earners in Finland, the Netherlands, and the United Kingdom. *Journal of Family Issues*, 38(1), 3-24.
- Tausig, Mark and Rudy Fenwick (2001). Unbinding time: Alternate work schedules and work-life balance. *Journal of Family and Economic Issues*, 22(2), 101-119.
- Totterdell, Peter. (2005) Work schedules. In: Barling, Julian, E. Kevin Kelloway & Michael R. Frone (Eds). *Handbook of work stress*, California: Sage Publications Inc, 35-62.
- Tucker, Philip and Simon Folkard (2012). *Working time, health and safety: A research synthesis paper*: ILO.
- Tuttle, Robert and Michael Garr (2012). Shift work and work to family fit: Does schedule control matter? *Journal of Family and Economic Issues*, 33(3), 261-271.
- Williams, Cara. (2008). Work-life balance of shift workers. *Perspectives on Labour and Income*, 20(3), 5-16.
- Wirtz, Anna and Friedhelm Nachreiner (2010). The effects of extended working hours on health and social well-being -A comparative analysis of four independent samples. *Chronobiology International*, 27(5), 1124-1134.
- Yildirim, Dilek and Zeynep Aycan (2008). Nurses' work demands and work-family conflict: A questionnaire survey. *International Journal of Nursing Studies*, 45(9), 1366-1378.
- Zhao, Isabella, Fiona Bogossian, and Catherine Turner (2010). Shift work and work related injuries among health care workers: A systematic review. *Australian Journal of Advanced Nursing*, 27(3), 62-74.