The role of work-privacy conflict, work factors and leadership on the psychological well-being of general practice personnel

Results from the IMPROVE*job* study

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List of abbreviations

BMBF	German Federal Ministry for Education and Research (*Bundesministerium für Bildung und Forschung*)
COPSOQ	Copenhagen Psychosocial Questionnaire
cRCT	Cluster-Randomised Controlled Trial
FIF	Questionnaire on Integrative Leadership (*Fragebogen zur Integrativen Führung*)
FRLM	Full Range of Leadership Model
GP	General Practitioner
JD-R	Job Demands-Resources
LMX	Leader-Member Exchange
NHS	National Health Service
OR	Odds Ratio
PrA	Practice Assistant
SD	Standard Deviation
TICS-SSCS	Trier Inventory for the Assessment of Chronic Stress – Screening Scale for Chronic Stress
UK	United Kingdom
US	United States
WPC	Work-privacy conflict

1 Abstract

Introduction: Healthy general practitioners and their teams are a fundamental component of a functioning primary care system that facilitates a healthy and longer-living population. However, the mental health of this population is at risk as they suffer from high chronic stress in comparison with other occupational groups. Among the main predictors of this perceived chronic stress are work-privacy conflicts, challenging work demands and poor leadership quality. However, quantitative models for German general practitioners and their teams are lacking. The publications of this dissertation are based on a comprehensive model of stress among general practice personnel, a review of work-privacy conflict and leadership and its correlates, and the efficacy of the cluster-randomised controlled IMPROVE*job* leadership trial.

Methods: This work draws on data from the IMPROVE*job* study of German general practitioners and their teams with initially 60 general practices and 366 participants (84 practice leaders, 28 employed physicians, 254 practice assistants) at baseline. Perceived chronic stress, work-privacy conflict, work demands and leadership were assessed using validated questionnaires. Multilevel regression models and paired t-tests were used for statistical analysis.

Results: A quantitative model identifies high levels of work-privacy conflict, high quantitative work demands and poor leadership quality as factors associated with high perceived chronic stress among general practice personnel. Work-privacy conflict is particularly pronounced in practice leaders, and full-time employees are more likely to suffer from work-privacy conflict. According to the Leader-Member Exchange Theory, practice leaders and their employees have a good relationship quality. The IMPROVE*job* intervention had no effect on job satisfaction but was rated very highly by the participants.

Discussion: The data show a need for strong leadership interventions in the general practice setting, as good leadership quality can have a positive influence on the psychological well-being of general practitioners and their teams. Reducing work-privacy conflict and work demands should also be targeted. Addressing these issues can have a positive impact on strengthening primary care, which in turn ensures better care for society.

2 Introduction

2.1 The importance of a strong primary care workforce

General practitioners (GPs) are a mainstay of healthcare in many countries (Forrest, 2003; Höhne et al., 2009). This became particularly evident during the COVID-19 pandemic, when primary care physicians were usually the first point of contact for patients (Dunlop et al., 2020). This makes it all the more important to maintain the workforce of primary care physicians, also in view of an increasingly aging, multimorbid society. But primary care is under threat as several countries are facing decreasing numbers of GPs (Iacobucci, 2019; Owen et al., 2019), also due to the fact that a large proportion of GPs will retire in the next few years (Nusbaum, 2009). At policy level, measures have already been taken to address the shortage of GPs (Kassenärztliche Bundesvereinigung, 2022; NHS, 2019). However, the needs and health of primary care physicians must also be addressed to ensure sustainable and stable care (Lesage et al., 2013; Søvold et al. 2021), which in turn affects the health of populations (Starfield et al., 2005; Tawfik et al., 2019; Wallace et al., 2009).

The importance of stable and comprehensive primary care has been demonstrated in numerous studies. Starfield et al. (2005) state that primary care, in contrast to specialty care, is associated with a more equitable health distribution in populations. Research from the United Kingdom (UK) shows that in regions with a shortage of primary care physicians, patients' health status is worse, even though everyone in the UK has access to primary care through the National Health Service (NHS) (Bankart et al., 2013). According to Baker et al. (2016) an increase of one GP per 1,000 patients in the UK is associated with a projected reduction of 6,738 (95 % confidence interval: 2,845–10,631) premature deaths. This is in line with a Canadian study which shows a significant impact of 2 % to 4 % on patients' self-reported general health status for every additional family physician per 10,000 persons (Sarma and Peddigrew, 2008). A 2008 study with data from 49,541 patients in England shows similar results: a 10 % increase in the number of family physicians increases the likelihood of reporting very good patient health by 6 % (Gravelle et al., 2008). A recent epidemiological study from 2019 using United States (US) population data and health insurance information from 2005 to 2015 shows the importance

of primary care again in comparison to specialty care. Increasing the number of primary care physicians by 10 per 100,000 population was associated with an increase in patients' life expectancy by 51.5 days. In contrast, increasing the number of specialists by 10 per 100,000 was associated with an only modest increase in life expectancy by 19.2 days (Basu et al., 2019).

All these studies illustrate the need for broad-based primary care, which is threatened, for example, not only by the regular retirement of primary care physicians (Nusbaum, 2009) but also by the loss of workforce through early retirement and higher turnover due to impaired psychological well-being. This was highlighted in a pan-European study by Soler et al. (2008) among 1,393 family physicians, which found that higher emotional exhaustion was associated with an increased use of sick days and an increased intention to change jobs.

2.2 Psychological burdens of general practitioners

High levels of psychological distress due to chronic stress and/or burnout are common among general practitioners. There is a strong evidence for this in many international studies: In a recent meta-analysis comprising 17 studies among 4,497 French general practitioners, findings revealed a prevalence of 48 % for burnout and 5 % for severe burnout (Kansoun et al., 2019). Approximately 50 % of 683 Irish GPs reported burnout symptoms in a cross-sectional study (O´Dea et al., 2017). A German study among 214 GPs showed a prevalence of 25 % of high chronic stress in the target group (Viehmann et al., 2017).

To address these risks of poor psychological well-being and ensure the health of GP personnel and populations, it is important to understand the factors that threaten the mental health of GPs. A widely cited model for predicting stress and burnout in the context of work is Bakker and Demerouti's (2007) Job Demands-Resources (JD-R) model, which states that stress/burnout is a result of high job demands and low job resources. A Canadian study tested this model in a sample of 407 physicians, including 151 GPs, using structural equation modelling. The results showed that job demands, represented by work overload and work-family conflict, significantly lead to emotional exhaustion, which in turn is associated with health problems. Health problems, on the other hand, are positively

correlated to the intention to leave the profession (Chênevert et al., 2021). In addition to the versatile JD-R model, there are other approaches to classifying the triggers of physician stress or burnout. A narrative review by Patel et al. (2018) groups the factors into three categories which are relevant to physician burnout: 1. Personal characteristics (including work-privacy conflict), 2. Work factors (including quantitative work demands) and 3. Organisational factors (including quality of leadership). Leadership also plays a role in the JD-R model and can be both a demand and a resource as shown in a recent review including 139 studies (Tummers and Bakker, 2021).

However, research on the psychological distress experienced by general practitioners has mainly focused on work demands or work-privacy conflict (WPC), or quality of leadership. Yet, there is a lack of studies that comprehensively address all three aspects simultaneously and describe their predictors and correlates.

2.3 The role of work-privacy conflict on psychological well-being

To better understand the triggers of chronic stress and burnout, it is important to understand the role of work-privacy conflict. WPC, also referred to in the literature as work-family conflict (Netemeyer et al., 1996) or work-life conflict (Hämmig et al., 2009), describes role conflicts between work and private life, such as overtime or childcare issues. Several studies have examined the difficulties physicians face in balancing work and personal life and reported on the impact of these difficulties on chronic stress or burnout. These inter-role conflicts are prevalent among physicians, as shown by a large US Mayo Clinic study, which reported that 44.3 % of 7,288 US physicians, including GPs, reported work-home conflict (by definition a similar construct to WPC) in the preceding three weeks. Interestingly, an even higher percentage, 55.7 %, was reported by the partners of physicians surveyed at the same time (Dyrbye et al., 2014). The same study found that physicians were more likely to experience burnout if they had recently experienced a work-home conflict (Dyrbye et al., 2014). A Swiss study among 1,755 primary care physicians identified excessive perceived stress due to difficulties in balancing professional and private life as a significant predictor of a high degree of burnout with an Odds Ratio (OR) of 2.2 (Goehring et al., 2005). Similarly, a US study of 422 family physicians and general internists from 119 practices reported that workplaces of

physicians with burnout were less likely to emphasise work-life balance in comparison to those without burnout (Rabatin et al., 2016).

2.4 The role of work factors on psychological well-being

In addition to WPC, work-related factors are important when considering the mental health of GPs. A study of 214 general practitioners and 550 practice assistants (PrA) in Germany identified long working hours as a significant contributor to perceived chronic stress in general practice teams (Viehmann et al., 2017). Furthermore, a recent cross-sectional study of 2,037 GPs in Switzerland identified administrative tasks as a contributor to higher levels of perceived stress (Glättli et al., 2021). This is consistent with a cross-sectional study of 109 German GPs that also found an association between administrative challenges in the practice and high chronic stress (Kersting et al., 2019). The quantitative findings are also supported by qualitative studies: For example, a Canadian study of 24 family physicians identified practice management as a source of stress (Lee et al., 2009), while a study of 47 GPs in England found that work demands were associated with physician stress (Riley et al., 2021). All of these findings indicate that GPs are exposed to high quantitative work demands, which in turn are associated with burnout and high levels of chronic stress.

2.5 The role of leadership on psychological well-being

Leadership itself is a broad construct and can be conceptualised in different theories. The Full Range of Leadership Model (FRLM) is one of the most extensively researched leadership frameworks, including transactional, transformational and negative leadership elements (Avolio, 2010; Bass, 1999). Transactional leadership involves leaders organising work scenarios, engaging in the transaction of contingent rewards (e.g. work for pay) and practising ‘management by exception’ (Avolio, 2010; Bass, 1999; Rowold and Schlotz, 2009). Compared to that, transformational leadership goes beyond the self-interest of both the leader and the followers. It focuses on employees' attitudes and values toward higher-level objectives like self-actualisation, organisational performance and the overall well-being of others and society (Avolio, 2010; Bass, 1999). Another widely-known leadership theory, Leader-Member Exchange (LMX), focuses specifically on the dynamics between leaders and followers and their perceived dyadic relationship (Bass, 1999; Graen

and Uhl-Bien, 1995). This process of social exchange between two individuals ranges from low levels of LMX, characterised by restricted social exchange (representing transactional leadership), to high levels of LMX, illustrating a transformational leadership approach characterised by high social exchange and an established partnership between leaders and followers (Graen and Uhl-Bien, 1995).

Understanding leadership in a medical context is important for the health of populations and also for the health of medical professionals. A systematic review including 18 studies showed strong correlations between improved leadership and several quality of care variables, including pain, safety measures and patients' 30-day mortality (Sfantou et al., 2017). The correlation between high levels of transactional leadership, high levels of LMX and low levels of burnout is meta-analytically proven for both leaders and employees (Harms et al., 2017). Similar to this, a recent systematic review investigating predictors of burnout with a total of 141 studies identified 15 studies on the relationship between better leadership and reduced burnout among various medical professionals in the US (Meredith et al., 2022). A study of 762 resident physicians at the Mayo Clinic found that for every 1-point increase in leadership quality, there was a corresponding 9 % decrease in the likelihood of experiencing burnout (Dyrbye et al., 2020). In another Mayo Clinic study by Shanafelt et al. (2015), leadership ratings explained 11 % of the variance in individual physician burnout among 2,813 physicians who were asked to rate their immediate physician/scientific leader. In addition to the impact of leadership on mental health, there is also evidence that the quality of leadership can be improved through targeted interventions. Saravo et al. (2017) found an enhancement in transactional and transformational leadership among 57 medical residents during hospital rotations following a four-week intervention.

2.6 Objectives

This dissertation is based on three publications and one submitted manuscript from the cluster-randomised controlled IMPROVE*job* trial. According to the study protocol, the intervention was designed to address structural stress prevention and behavioural stress prevention for practice leaders, employed physicians and PrAs. In addition to the primary outcome of job satisfaction, several secondary outcomes were assessed, including

chronic stress, leadership aspects and (psychosocial) working conditions (Weltermann et al., 2020). The manuscripts and publications of this doctoral thesis had the following objectives:

1. To identify associated variables of chronic stress in German GP personnel;
2. To describe the distribution of WPC among GP personnel and its associated variables;
3. To compare leader and employee ratings of leadership using an innovative 180-degree approach;
4. To analyse the effectiveness of the IMPROVE*job* leadership intervention.

2.7 Methods

2.7.1 Study design

The cluster-randomised controlled trial (cRCT) evaluates the effectiveness of the IMPROVE*job* leadership intervention in improving the primary outcome of job satisfaction and several secondary outcomes such as chronic stress, WPC, work demands and leadership. Randomisation to the intervention or control group was performed at the level of the practice, with intervention group practices receiving the intervention after the initial data collection (baseline) and control group practices receiving it after study completion. A more detailed overview of the methodology is published in the study protocol (Weltermann et al., 2020).

The study complies with the ethical principles of the World Medical Association Declaration of Helsinki and was first approved by the Ethics Committee of the Medical Faculty of the University of Bonn (reference number: 057/19, date of approval: 20/02/2019). In addition, the Ethics Committees of the North Rhine State Chamber of Physicians (Lfd-Nr.: 2019107) and of the Medical Faculty of the University Hospital of Tuebingen (Project No.: 446/2019BO2) gave a positive vote. This study was funded by the German Federal Ministry for Education and Research (BMBF; grant numbers: 01GL1851D, 01GL1751B, 01GL1751A, 01GL1751C).

2.7.2 Population and recruitment

According to the sample size calculation in the study protocol, the study aimed to include a sample of 56 practices, each with an average of 4 participants (Weltermann et al., 2020). A total drop-out of 4 practices (2 each in the intervention and control groups) was already accounted for (Weltermann et al., 2020). The final sample at baseline consisted of 60 practices with 84 practice leaders, 28 employed physicians and 254 practice assistants randomised to either the control or the intervention group (n = 366; 87.1 % female; M_{Age} = 44.4) (Degen et al., 2021). These were stratified according to the characteristics *individual/group practice* and *teaching/non-teaching practice*. Each participant received an incentive of 50€. The baseline data collection took place before the outbreak of the COVID-19 pandemic in Germany. Follow-up data were collected between October 2020 and April 2021.

2.7.3 IMPROVE*job* intervention

The final multimodal, participatory intervention was designed by experts specialising in general practice, occupational medicine, psychosomatic medicine, operations research and workplace health promotion. The content of the intervention focused on the core elements leadership, communication and work processes. In addition to two workshops (one for practice leaders, one for practice leaders and teams), the intervention included a toolbox with additional materials and a nine-month support phase by trained PrAs (so-called IMPROVE*job* facilitators). A detailed overview of the intervention content is shown in Figure 1.

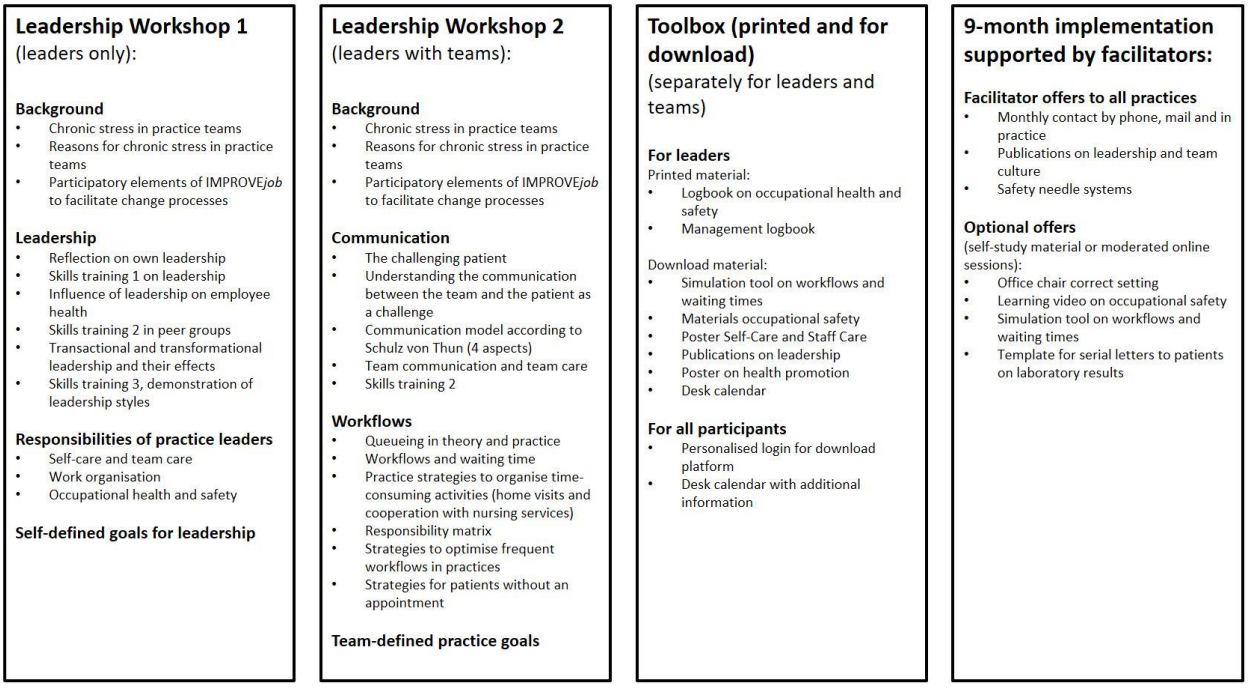

Figure 1: Main elements of the IMPROVE*job* intervention (adapted from Degen et al., 2021)

2.7.4 Outcome measures

The questionnaire for the IMPROVE*job* study consisted of validated inventories and was completed by the participants using the paper-and-pencil method. In addition to socio-demographic information, the main questionnaires on which this dissertation is based are the following:

- **Perceived chronic stress:** The TICS-SSCS (Trier Inventory for Chronic Stress – Screening Scale for Chronic Stress) retrospectively measures perceived chronic stress over the past 3 months. The questionnaire comprises 12 items using a 5-point Likert scale (e.g. ‘In the last three months, how often did you experience fear of not being able to perform your duties?’; 0= ‘never’ to 4= ‘very often’). According to the manual, it is suitable for work-related diagnostics for both self-employed persons and employees (Schulz et al., 2004). For evaluation, a sum score of all items is calculated, resulting in scores ranging from 0 (never stressed) to 48 (very often stressed). An internal validity of Cronbach’s alpha = 0.91 is reported for the norm sample (Schulz et al., 2004).

- **Work-privacy conflict, quantitative demands, emotional demands and job satisfaction** were measured using the corresponding scales from the Copenhagen Psychosocial Questionnaire (German COPSOQ, version 2018) (Burr et al., 2019), a widely used instrument to measure psychosocial factors in the workplace (Lincke et al., 2021).

  The scale on **WPC** comprises two items (e.g. 'The demands of my work interfere with my home and family life.') with high internal validity (Cronbach's alpha = 0.92) (Burr et al., 2019). The scale assessing **quantitative demands** comprises five items (e.g. 'How often do you not have time to complete your work tasks?'; Cronbach's alpha = 0.81) (Burr et al., 2019) and the **emotional demands** scale consists of two items (e.g. 'Do you have to deal with other people's personal problems as part of your work?'; Cronbach's alpha = 0.74). Item response options range from 'always' to 'never/hardly ever' (Burr et al., 2019). The scale on **job satisfaction** comprises five items plus a sixth global item ('How pleased are you with your job as a whole, everything taken into consideration?'; item options range from 'not satisfied at all' to 'fully satisfied'; Cronbach's alpha = 0.79). The raw values were summed and converted into a metric scale ranging from 0–100 with high scores indicating high levels of WPC, quantitative/emotional demands and job satisfaction (Burr et al., 2019). For more details on the COPSOQ metrics, see Burr et al. (2019), Lincke et al. (2021) and Nübling et al. (2006).
- **Leadership** was measured with the Integrative Leadership Questionnaire (FIF, Fragebogen zur Integrativen Führung; Rowold and Poethke, 2017) and the LMX-7 questionnaire (Schyns and Knoll, 2014). Based on the FRLM, the FIF assesses transactional, transformational and negative leadership using 40 items (e.g. 'My manager communicates the meaning and background of upcoming tasks and goals.') on a 5-point Likert scale. There is a global scale and several subscales for transformational (innovation, team spirit, performance development, individuality focus, providing a vision, being a role model), transactional (goal setting, management by exception) and negative (laissez-faire and destructive) leadership. Each scale results in a mean score that ranges from 1 to 5 (Rowold and Poethke, 2017). At the practice level, an aggregate score was created by averaging both the practice leader's self-assessment and the employees' ratings of their direct leader.

The LMX-7 assesses the quality of the relationship between practice leaders and their staff using seven items on a 5-point Likert scale (e.g. ‘How would you characterise your working relationship with your leader/your member?’). The scale was analysed by summing all scores, resulting in a total score ranging from 7 to 35 (Cronbach’s alpha = 0.92) (Schyns and Knoll, 2014). The values are divided into the following categories for descriptive interpretation: 7 to 14 = very low, 15 to 19 = low, 20 to 24 = moderate, 25 to 29 = high, 30 to 35 = very high (Northouse, 2021). In our sample, question seven was missing for all employed physicians (n = 28). This subpopulation was therefore excluded from the LMX analyses because the handling of missing values is not defined in the manual (Schyns and Knoll, 2014).

2.7.5 Statistical analysis

Where appropriate, we ran multilevel regression models with random intercepts to take into account the clustered structure of the data. For the 180-degree feedback approach at the practice level, paired t-tests were used to compare employees’ leadership ratings of their leader with the leader's self-rating. According to the manual, FIF scores were transformed into a standard scale (T-scale) with a mean value of 50 and a standard deviation (SD) of 10. Effect sizes were reported in R^2 or Cohen’s d according to Cohen (1988). Means and SDs of the scales are reported for a consistent comparison of results. Statistical analyses were conducted using SPSS Statistics 27 (IBM Corporation, Armonk, NY, USA, 2020) and R version 4.2.2 with the lme4 package. The significance level was set at $p < 0.05$.

2.8 List of figures

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3 Publications

3.1 Publication 1 (under review)

Göbel J, Degen L, Minder K, Rieger MA, Weltermann B. Strong association of perceived chronic stress with leadership quality, work-privacy conflict and quantitative work demands: results of the IMPROVE*job* study, Scientific Reports, 2023 (under review)

Strong association of perceived chronic stress with leadership quality, work-privacy conflict and quantitative work demands: results of the IMPROVE*job* study

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Abstract: The health of primary care professionals is crucial for the health of populations. A low number of general practitioners per 1000 patients correlates with high patient mortality. Challenging work demands, work-privacy conflict, and poor leadership quality are associated with higher perceived chronic stress and/or burnout in physician populations. However, studies investigating the influence of all three factors in a quantitative model are lacking. This study analyzed the associations between the mentioned parameters and perceived chronic stress among general practice personnel based on baseline data of the cluster-randomized IMPROVE*job* study comprising 60 German general practices with 366 participants (84 general practice leaders, 28 employed physicians, 254 practice assistants). Perceived chronic stress (TICS-SSCS), leadership quality (LMX-7, FIF), work-privacy conflict (COPSOQ) and quantitative and emotional work demands (COPSOQ) were measured with validated questionnaires. The factors associated with lower perceived chronic stress were identified using a multilevel regression model approach. The model showed a significant association with less pronounced work-privacy conflict (p<.001, β=0.31), lower quantitative work demands (p<.001, β=0.28), and good leadership quality (p<.001, β=-0.22). Especially transformational leadership with the dimension "innovation of the leader" was associated with lower perceived chronic stress. The data support the importance of high-quality leadership as a protective factor for perceived chronic stress among general practice personnel, which needs to be considered in future leadership interventions in this setting.

Trial registration: German Clinical Trials Register, DRKS00012677. Registered 16 October 2019.

Strong associations of perceived chronic stress with leadership quality, work-privacy conflict and quantitative work demands: results of the IMPROVE*job* study

Background

The well-being of the primary care workforce is fundamental to sustainable health care systems [1,2] and the health of populations [3]. However, this is at risk in many nations [4–6] such as the UK and Germany, which are suffering from a shortage of primary care physicians [4,7,8]. A comprehensive investigation of general practices in England found a significant negative correlation between patient mortality and the number of general practitioners (GP) per 1000 patients (-4.31, 95% CI -6.8 to -1.8) [9]. In addition, a retrospective observational study in England showed an association between an increased turnover in general practice and lower patient satisfaction with the practice (-1.3; 95% CI -1.6 to -1.1), higher emergency attendances per 100 patients (1.8; 95% CI 1.5 to 2.1), and lower availability of same-day appointments (-10.6; 95% CI -11.4 to -9.0) [10]. Key factors for the GP demand-supply mismatch are early [11] and regular retirement of GPs [12], demographic changes with longevity of patients, more elderly people requiring care [13], and increased GP turnover rates due to psychological strains such as perceived chronic stress (CS), burnout and job dissatisfaction [14–16]. To address these issues, many countries have initiated policies of various kinds, such as the NHS Long Term Plan in the United Kingdom [17] or the German Social Code Book V (SGB V §75a) in Germany [18].

The magnitude of the problem is illustrated in a large number of studies, which address various psychological outcomes among GPs, such as perceived chronic stress, burnout and poor job satisfaction. The prevalence of high perceived chronic stress was 25% in a German study of 214 general practitioners [19]. Internationally, most studies have focused on the outcome burnout, which is related to intentions to leave the job [15,16]. A recent meta-analysis of 17 studies among 4,497 French GPs showed a prevalence of 48% for burnout and 5% for severe burnout [20]. About 50% of 683 Irish GPs experienced burnout symptoms [21]. In a European-wide study in 12 countries by the European General Practice Research Network, 12% of 1,393 family doctors scored high on all dimensions of burnout [22].

These psychological strains are mainly caused by three factors, namely challenging working conditions, work-privacy conflict (WPC) and poor leadership quality [23]. Regarding work demands, a German study of general practice teams with 214 GPs and 550 practice assistants identified long working hours as a source of perceived chronic stress [19]. In a qualitative study with 24 Canadian family physicians, practice management challenges were identified as stressors [24]. Similarly, administrative tasks contributed to higher perceived stress levels in a recent cross-sectional study of 2,037 GPs in Switzerland with higher perceived stress levels in younger (<40 years of age) compared to older GPs

[25]. In addition to these high work demands, work-privacy conflicts are relevant. In one of our previous publications, GP leaders reported more than 50% higher work-privacy conflict scores than the German reference population with over 200,000 participants [26]. These difficulties in balancing professional and private life were identified as a predictor for a high degree of burnout in various studies, e.g. among 1,755 Swiss primary care physicians with an OR of 2.2 [27] and 422 US primary care physicians [11].

In addition to quantitative work demands and work-privacy conflict, leadership quality is a major driver for perceived chronic stress and burnout. A recent systematic review of 15 studies showed associations between better leadership and lower levels of burnout in US medical professionals [28]. For example, a study among 762 resident physicians from the Mayo Clinic reported that a 1-point increase in leadership quality was associated with a 9% decrease in the odds of experiencing burnout [29]. Similar results were obtained in a large meta-analysis of 22 studies with 6,861 participants from various occupational fields: higher leadership quality was strongly associated with lower perceived leader and subordinate stress levels (overall correlation of r_s = -0.35) [30].

So far, studies of GPs psychological strains focus either on various work demands, work-privacy conflict and/or leadership quality, but studies addressing all three aspects are lacking. The study presented here draws on baseline data from the cluster-randomised controlled IMPROVE*job* intervention study [31,32]. We investigate the role of work demands, work-privacy conflict and leadership quality as predictors for perceived chronic stress in general practice personnel.

Methods

This study analysed baseline data from the IMPROVE*job* study among 366 professionals (84 practice leaders, 28 employed physicians and 254 practice assistants) from 60 practices in the North-Rhine region of Germany. The IMPROVE*job* study was a participatory, cluster-randomised, controlled intervention trial to improve job satisfaction of German GP practice teams. The IMPROVE*job* intervention comprised multimodal, innovative leadership training on leadership skills, communication and workflows [32]. The baseline data collection was completed in January 2020 prior to the COVID-19 pandemic. The study protocol and baseline data are published [31,32].

Outcome measures

Questionnaires requested the following data:

- Sociodemographic and work characteristics: sex (m/f), age (in years), leadership responsibility (yes/no), part-time vs. full-time work.

- Perceived chronic stress: The validated TICS-SSCS (Trier Inventory for Chronic Stress – Screening Scale for Chronic Stress) measures the perceived burden of chronic stress in the last three months. It consists of 12 items with a 5-point Likert scale answering format (e.g. 'In the last three months, how often did you experience fear of not being able to perform your duties?'; 0= 'never' to 4= 'very often') and is suitable for use in work-related diagnostics for both employees and self-employed persons [33]. A sum score of all 12 items is calculated, resulting in a score from 0 to 48 with 0 meaning 'never stressed' and 48 meaning 'very often stressed'. The internal validity of the TICS-SSCS is excellent with a Cronbach's alpha of 0.91 [33].
- Work demands and work-privacy conflict: These were measured using the corresponding scale of the Copenhagen Psychosocial Questionnaire (German COPSOQ, version 2018) [34]. The COPSOQ is a validated instrument for measuring psychosocial factors at work [35]. The quantitative demands scale consists of five items (e.g. 'How often do you not have time to complete your work tasks?') and has a high internal validity (Cronbach's alpha = 0.81). The emotional demands scale is based on two items (e.g. 'Do you have to deal with other people's personal problems as part of your work?') and has a high internal consistency (Cronbach's alpha = 0.74). The work-privacy conflict scale consists of two items (e.g. 'The demands of my work interfere with my home and family life.') and has a high internal validity (Cronbach's alpha = 0.92). The response options for the scales are: always, often, sometimes, seldom, never/hardly ever. Following the COPSOQ manual, these were transformed into a numerical scale from 0–100, with high values indicating strong quantitative demands, emotional demands and work-privacy conflicts.
- Quality of Leadership: This was assessed using the LMX and FIF questionnaire.
- Leader-Member Exchange: The Leader-Member Exchange questionnaire (LMX-7) measures the quality of relationships between practice leaders and their staff with seven items on a 5-point Likert scale (e.g. 'How would you characterise your working relationship with your leader/your member?'). The LMX-7 reflects the widespread concepts of transactional and transformational leadership [36]. The scale is analysed by calculating a sum score of all seven items with results ranging from 7 to 35 [37]. The resulting five score categories describe the quality of leader-member exchange: 7 to 14 = very low, 15 to 19 = low, 20 to 24 = moderate, 25 to 29 = high, 30 to 35 = very high [38]. The internal consistency is high (Cronbach's alpha = 0.92) [37]. Incidentally, question seven was missing for all employed physicians (n = 28) who were therefore excluded from LMX analyses.
- Integrative Leadership Questionnaire (FIF): The validated FIF questionnaire measured transformational and transactional leadership with 40 items answered on a 5-point Likert scale (e.g. 'My manager communicates the meaning and background of upcoming tasks and goals.'). All

scales are analysed by calculating a mean score, ranging from 1–5. Transformational and transactional leadership are reported as global mean scores and in sub dimensions: innovation, team spirit, performance development, individuality focus, providing a vision and being a role model (transformational leadership), and goal setting and management by exception (transactional leadership) [39]. At the practice level, an overall score was created by averaging the practice leader's self-assessment and the employees' external assessment of their leader.

Statistical analysis

To enable comparability of results, means and standard deviations of the scales are reported. Pearson correlation analysis of all included scales were also performed to illustrate the data structure. Due to the clustered structure of the data, we calculated multi-level regression models with random intercepts. We conducted a stepwise analysis approach: The first model focused on the interaction of quantitative and emotional work demands, work-privacy conflict and leadership as predictors of perceived chronic stress. To ensure comparability of the coefficients of determination with other studies and to be able to report them as percentages, the significant predictors were then included in linear regression models. The second regression model addressed leadership styles and the third focused on sub dimensions associated with perceived chronic stress of GPs and practice assistants. Models 2 and 3 were applied to the total population and to the subpopulation of practice assistants due to their high perceived chronic stress [31]. This approach aimed at identifying the leadership dimensions that protect against high perceived chronic stress. Effect sizes were reported in R^2 according to Cohen [40].

All statistical analyses were performed using SPSS Statistics 27 (IBM Cooperation, Armonk, Ny, USA, 2020) and R version 4.2.2 with the lme4 package.

The study was first approved by the Ethics Committee of the Medical Faculty of the University of Bonn (reference number: 057/19, date of approval: 20 February 2019).

Results

Descriptive analysis of sociodemographic parameters

Of the 60 participating practices, 21 were solo practices and 39 were group practices. At the practice level, the proportion of the participating staff ranged from 20.0 to 100% (mean = 73.4%). The mean age of the population was 44.4 years (*SD* = 12.8); practice leaders were slightly older than practice staff and more likely to be working full-time (see Table 1 for details).

Table 1: Sociodemographic characteristics of the population (Degen 2021)

Sociodemographic description	Total sample	Practice leader	Employed physician	Practice assistant
Variable	*n* = 366	*n* = 84	*n* = 28	*n* = 254
Female, %	87.1	52.4	78.6	99.6
Age in years, mean (SD)	44.4 (12.8)	54.3 (6.2)	44.8 (9.8)	41.0 (13.0)
Working full-time, %	52.0	90.5	28.6	41.5

Work demands, work-privacy conflict and leadership (including Model 1)

The overall mean perceived chronic stress score of the population was 19.02 (*SD* = 8.80, *median* = 19) [31]. Our analyses show that practice assistants reported the highest subjective chronic stress. Quantitative demands were highest for practice leaders, followed by practice assistants and employed physicians. In our sample, practice leaders reported the highest emotional demands, followed by employed physicians and practice assistants. Practice leaders reported better leadership quality than practice assistants (see Table 2 for details) [41] and work-privacy conflict was most pronounced in the practice leader group [26].

Table 2: Descriptive statistics of the main variables. *Perceived chronic stress (TICS; ranging from 0–48, high scores imply high chronic stress). Quantitative demands (COPSOQ, ranging from 0–100, high scores imply high quantitative demands), emotional demands (COPSOQ, ranging from 0–100, high scores imply high emotional demands) and work-privacy conflict (COPSOQ, ranging from 0–100, high scores imply high conflicts). Leadership quality (LMX-7, ranging from 7–35, high scores imply good leadership quality). Values stratified by occupational groups.*

	Total	Practice leader	Employed physicians	Practice assistants
Perceived chronic stress (TICS), mean (SD)	19.02 (8.80)	18.15 (8.13)	16.38 (7.60)	19.60 (9.10)
	N=361	N=83	N=28	N=250
Quantitative demands (COPSOQ), mean (SD)	60.53 (16.92)	67.28 (15.22)	55.80 (18.54)	58.72 (16.70)
	N=366	N=84	N=28	N=254
Emotional demands (COPSOQ), mean (SD)	69.10 (21.25)	86.01 (11.64)	75.93 (14.80)	62.59 (20.97)
	N=356	N=84	N=27	N=245
Work-privacy conflict (COPSOQ), mean (SD)	40.85 (31.51)	64.03 (29.96)	45.54 (30.28)	32.67 (28.35)
	N=366	N=84	N=28	N=252
Leadership quality (LMX-7), mean (SD)	26.72 (4.40)	28.10 (2.6)	n/a	26.70 (4.8)
	N=303	N=81	n/a	N=222

Table 3: Bivariate correlations of the metric variables on individual level

Variable	1	2	3	4
Chronic stress (TICS)	.485**	.192**	.456**	-.315
Independent variables				
1. Quantitative demands (COPSOQ)	-	.380**	.549**	-.120*
2. Emotional demands (COPSOQ)	.380**	-	.395**	.094
3. Work-privacy conflict	.549**	.395**	-	-.119*
4. Leadership quality (LMX-7)	-.120*	.094	-.119*	-

Annotations: * $p < .05$. ** $p < .01$.

A multilevel regression model taking into account the clustered data structure showed a significant influence of a higher LMX score as a global leadership variable (p<.001), lower quantitative demands (p<.001), lower work-privacy conflict (p<.001), higher age (p<.001) and having leadership responsibility (p<.01) on lower perceived chronic stress (Table 4). The model showed an adjusted R^2 = .37. Single linear regression models of the significant predictors of perceived chronic stress yielded adjusted determination coefficients of R^2 = .13 for leadership (p<.001), R^2 = .21 for WPC (p<.001) and R^2 = .23 for quantitative demands (p<.001).

Table 4: Multilevel model with the independent variables leadership quality, quantitative demands, emotional demands, work-privacy conflict, age, leadership responsibility and working full-time/part-time on the dependent variable perceived chronic stress

	b	SE_b	*β*	*t*
Quantitative demands* **	**0.15**	**0.03**	**0.28**	**5.57**
Emotional demands	0.04	0.02	0.09	1.74
Work-privacy conflict* **	**0.09**	**0.02**	**0.31**	**5.64**
Leader-Member Exchange (LMX-7)* **	**-0.45**	**0.09**	**-0.22**	**-4.44**
Age* **	**-0.14**	**0.04**	**-0.20**	**-3.43**

Leadership responsibility[a]**	**3.00**	**1.22**	**0.14**	**2.92**
Working full-time/part-time[b]	1.12	0.90	0.06	0.45

Annotations: Adjusted R^2 = .37, ***p < .001, **p < .01; b = regression coefficient b; SE_B = standard error; β = standardised regression coefficient; t = t-value; [a] coded as: 1=yes, 2=no; [b] coded as 0=full-time, 1=part-time; significant variables printed in bold

Leadership dimensions (models 2 and 3)

Model 2: The regression model shows that higher transformational leadership (FIF) (b = -2.68, p = .012), higher Leader-Member Exchange (LMX-7) (b = -0.37, p = .024) and higher age (b = -0.10, p = .024) are significantly associated with lower perceived chronic stress.

Model 3: With the finding that transformational leadership is the most influential protective leadership factor for perceived chronic stress, we considered the influence of the subscales of transformational leadership on CS. The multilevel model shows a significant association of the subscale 'innovation of the leader' with CS, identifying a high grade of innovation as a protective factor for CS (b = -2.23, p = .018).

Because practice assistants report the highest levels of perceived chronic stress descriptively, we looked at this subgroup in more detail. In line with our previous analyses, transformational leadership (b = -3.56, p < .001) and especially innovation of the leader (b = -2.23, p = .018) are significantly associated with CS.

Discussion

Our analysis showed that low work-privacy conflict, low quantitative work demands and high leadership quality were the strongest predictors for a low level of perceived chronic stress in a multilevel model resulting in a high adjusted R^2 of 0.37. Our analysis was based on the idea that multi-parameter scenarios like GP practices need to be investigated with multi-parameter approaches. This is in line with a conceptual model by Linzer et al. showing various predictors of perceived stress among primary care physicians in 2009, including organisational and leadership factors [42], and with a narrative review by Patel [23]. However, neither of these publications reported any effect sizes of the identified predictors. The review by Patel et al. conceptualised three key aspects with sub dimensions which are relevant for physician burnout: a) organisational factors (according to the authors e.g. quality of leadership), b) personal characteristics (according to the authors e.g. work-privacy conflict) and c) work factors (e.g. quantitative demands) [23].

The importance of leadership in the explanation of perceived chronic stress or burnout is supported by various studies: In a large US Mayo Clinic study by Shanafelt et al., 2,813 physicians were asked to rate their direct physician/scientific leader. The leadership ratings explained 11% of the variance in individual physician burnout and 47% of the variance in organisational satisfaction [43]. These are notable effects given that lower job satisfaction is strongly negatively correlated with chronic stress [31]. These results on leadership are quite similar to our analysis, showing an explained variance of 13% of chronic stress in linear regression models. These are remarkably high coefficients compared to a Hungarian study of 350 general practitioners, which identified age, gender and fewer years in practice as predictors of burnout. The regression models on different burnout dimensions showed an adjusted R^2 of 0.023–0.031 [44]. Likewise, a 2010 Norwegian longitudinal study examined predictors of physician burnout among 683 participants in a multiple regression model. Individual factors, work characteristics and work-home conflict were also analysed but leadership parameters were not taken into account [45]. Our study addressed leadership quality in combination with work demands and work-privacy conflict and helps to understand the development and prevention of perceived chronic stress in populations that have been shown to be highly burdened [31,46]. Interestingly, leadership responsibility was not found to be a significant predictor of perceived chronic stress, despite the manifold tasks, demands and (managerial) responsibilities of practice leaders. This finding is consistent with Karaseks well-known *job demand-control model*, which postulates that high job demands combined with high perceived control (job decision latitude) define an active job and promote the development of new behaviour patterns, whereas high job demands combined with low control promote the risk of psychological strain [47].

Regarding personal characteristics (work-privacy conflict, assigned according to Patel et al. 2018 [23]) and work factors (quantitative work demands), our results are in line with a Swiss study of 1755 primary care physicians, which used a logistic regression approach to identify work-related stressors together with job and psychosocial characteristics as potential sources of burnout [27]. The regression model in that study explained 19% of the variance. In comparison, our comprehensive multilevel model explained almost twice as much of the variance. This may be due to the inclusion of leadership predictors, which show a high regression coefficient in our model, supporting the importance of leadership in the context of general practice. Further analyses revealed that transformational leadership, including especially the 'innovation of the leader' sub dimension, was the strongest protective leadership factor for perceived chronic stress. These results were confirmed for the particularly stressed subgroup of practice assistants. In our model, work-privacy conflict had a significant impact on the perceived chronic stress among GPs and practice assistants. Our bivariate correlation analyses suggest that the relationship between work-privacy conflict and perceived chronic stress is moderated by leadership.

Several work factors are related to perceived chronic stress in general practice including long working hours/high workload, pressure on practice teams, high levels of bureaucracy, poor workflows, emotional demands and poor team culture [48–51]. Our analysis included these factors, using the COPSOQ scales for quantitative and emotional demands. The comprehensive regression model showed that quantitative demands are a highly significant predictor, in line with the studies mentioned above [48–51] [REF].

In 2017, Shanafelt and Noseworthy published nine organisational strategies to reduce physician burnout [52]. These are mostly top-down and include both leadership and work-privacy balance aspects. However, the difficulty lies in transferring such frameworks addressing larger organisations to the context of general practice, as most GP practices in Germany, for example, are owner-managed. Interventions must therefore shift the focus from the organisation to the practice leader, and should consider teaching and training different leadership styles (transformational with a high degree of leader's innovation), which have been shown to be particularly protective factors against perceived chronic stress.

Strengths and limitations

We used a multilevel regression approach with several models to examine the dynamic work environment of general practices in terms of perceived chronic stress and its protective factors. Based on large data from 60 German general practices, the interplay of important parameters such as leadership was analysed, but transfer of results to other settings needs to be handled with caution. Results are based on cross sectional data, which do not allow for a causal interpretation.

Conclusion and practical implications

Our study showed that leadership quality, quantitative work demands and work-privacy conflict are significantly associated with perceived chronic stress among GPs and their practice staff. Intervention strategies should respect for these parameters to improve professionals´ well-being.

Data availability

There are no plans to grant access to full protocol, participant-level datasets, or statistical codes, as data contain potentially identifying information.

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Author contributions

BW had the study idea. BW and MAR conceptualized the IMPROVE*job* project. JG, LD and BW developed the idea for the manuscript and analysed the data. JG drafted the first version of the manuscript together with LD and BW. All authors contributed to the study conduct, provided feedback on the manuscript and approved the final version.

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Competing Interest
The authors declare no competing interests.

Ethics approval
The study complies with the ethical principles of the World Medical Association Declaration of Helsinki. The study was first approved by the Ethics Committee of the Medical Faculty of the University of Bonn (reference number: 057/19, date of approval: 20/02/2019). In addition, the Ethics Committees of the Medical Association of North Rhine (Lfd-Nr.: 2019107) and of the Medical Faculty, University Hospital of Tuebingen (Project-No.: 446/2019BO2) agreed.
Informed consent statement: All participating practice team members received written information and signed informed consent forms, which will be stored at the Institute for General Practice and Family Medicine, University of Bonn.

3.2 Publication 2

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Higher Work-Privacy Conflict and Lower Job Satisfaction in GP Leaders and Practice Assistants Working Full-Time Compared to Part-Time: Results of the IMPROVE*job* Study

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Abstract: Background: Work-privacy conflict (WPC) has become an important issue for medical professionals. The cluster-randomized controlled IMPROVE*job* study aimed at improving job satisfaction (primary outcome), with additional outcomes such as examining the work-privacy conflict in German general practice personnel. Using baseline data of this study, the relationship between work-privacy conflict and job satisfaction (JS) was analyzed. In addition, factors associated with higher WPC were identified. Methods: At baseline, 366 participants (general practitioners (GPs) in leadership positions, employed general practitioners, and practice assistants) from 60 German practices completed a questionnaire addressing socio-demographic data and job characteristics. Standardized scales from the German version of the COPSOQ III requested data concerning job satisfaction and work-privacy conflict. Both scores range from 0 (lowest) to 100 (highest). Multilevel analysis accounted for the clustered data. Statistical analyses were performed using IBM SPSS and RStudio software, with a significance level set at $p < 0.05$. Results: Job satisfaction was 77.16 (mean value; SD = 14.30) among GPs in leadership positions ($n = 84$), 79.61 (SD = 12.85) in employed GPs ($n = 28$), and 72.58 (SD = 14.42) in practice assistants ($n = 254$). Mean values for the WPC-scale were higher for professionals with more responsibilities: GPs in leadership positions scored highest with 64.03 (SD = 29.96), followed by employed physicians (M = 45.54, SD =30.28), and practice assistants (M = 32.67, SD = 27.41). General practitioners and practice assistants working full-time reported significantly higher work-privacy conflict than those working part-time ($p < 0.05$). In a multilevel analysis, work-privacy conflict was significantly associated with job satisfaction ($p < 0.001$). A multiple regression analysis identified working hours, as well as and being a practice owner or an employed physician as factors significantly influencing WPC. Discussion: WPC was high among general practice leaders and practice personnel working full-time. Future interventions to support practice personnel should focus on reducing WPC, as there is good evidence of its effects on job satisfaction.

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1. Introduction

In times where work environments are changing at an ever-faster pace, professional matters frequently conflict with employees' private lives [1]. In the Copenhagen Psychosocial Questionnaire (COPSOQ), this role conflict is described as "work-privacy conflict" (WPC) [2]. Typical examples are private conflicts caused by long working hours, or having to leave work early due to child care issues or other life phase-specific needs [3]. Historically, WPC is related to research of Netemeyer et al. in 1996 [4], who examined the concept of work-family conflict with two directions: work interference with family (WIF) and family interference with work (FIW). Later, this concept was further developed: the term "work-life-conflict" came to include persons who do not live in traditional family units [5]. Garthus-Niegel et al. (2016) outlined that this term falsely suggests that work is separated from life and introduced the term "work-privacy conflict," which most precisely describes potential role conflicts between professional and private lives [6]. All three constructs mentioned describe inter-role conflicts and are therefore closely related, allowing for comparisons between the studies [4].

Inter-role conflicts regarding work and private life are frequent among medical professionals: 44.3% of 7288 US physicians of all disciplines reported a work-home conflict, a construct similar to WPC, in the previous three weeks [7]. Physicians' partners, who were surveyed parallelly, reported an even higher number of 55.7% [7]. Similarly, 47.8% of 543 physicians from German-speaking Switzerland suffered from a strong work-life conflict [8]. Among 296 German hospital physicians, the average WPC score was 74 (scale: 0 = lowest to 100 = highest on the German version of the COPSOQ), which differed significantly from a score of 45 for the German general working population [9]. According to a meta-analysis by Byron (2005) with over 60 articles, a high number of working hours is a risk factor for work-family conflict, while schedule flexibility is protective [3].

Spector defined job satisfaction (JS) as "the extent to which people like or dislike their jobs" [10]. According to a 2006 review, a high number of working hours, administrative burdens, unsatisfactory income, high workload, lack of time, and lack of recognition were negatively associated with the GPs' job satisfaction [11]. Furthermore, a narrative review by Williams et al. outlined that poor job satisfaction in GPs is associated with more dissatisfied and less adherent patients [12]. Based on data from 676 German GPs and 2878 non-physician employees, Goetz et al. showed that non-physician practice staff rated their job satisfaction higher than GPs, except for the item "recognition for work" measured by the Warr–Cook–Wall questionnaire [13].

In several studies, low work-family conflict correlates with lower job stress [3] and lower burnout [14]. In reverse, high work-family conflict decreases job satisfaction [15–17]. In the field of medicine, for example, this interrelationship could be demonstrated for 351 Italian nurses [18] and 3535 Chinese physicians of all specialties [19]. Job satisfaction was studied in several GP populations [11–13]; there is already data measuring WPC among German hospital physicians [9]. Research of WPC and associations between WPC and job satisfaction in general practice personnel, stratified by occupational groups, is missing. Yet, such research is important for several reasons: first, primary care is secured mainly by the workforce of general practitioners and their teams [20]; second, data from hospital-based physicians cannot be extrapolated to German GPs, who predominantly own their practices, including all medical, financial, and administrative obligations. Therefore, we assume high WPC for practice owners following Garthus-Niegel et al., who described high WPC scores among self-employed individuals from a German random sample [6].

This study draws on baseline data from the IMPROVE*job* study, which is a prospective cluster-randomized controlled study to improve job satisfaction among GPs and practice

personnel [21]. Here, we analyze the relationship between work-privacy conflict and job satisfaction in German general practitioners and practice assistants regarding work conditions.

2. Materials and Methods

2.1. Study Design

This study analyzes baseline data from the IMPROVE*job* study regarding the relationship between WPC and JS. Factors influencing WPC are also investigated. The details of the IMPROVE*job* study are described in the study protocol [21]; the socio-demographic data of the study population are published by Degen et al. [22].

In short, the publicly funded IMPROVE*job* study is a cluster-randomized controlled intervention trial (cRCT) with 60 general practices, 84 physicians in a leadership position, 28 employed physicians, and 254 practice assistants. The primary outcome is the change in job satisfaction after nine months. In addition, various secondary outcomes, such as WPC, quantitative, and emotional work demands were assessed. Participating GP practices were recruited from two university teaching practice networks and non-teaching practices from Germany's North Rhine region. Study nurses collected baseline and follow-up data in the practices in a paper-pencil format. Every participant who completed the follow-up questionnaire received a monetary incentive [21]. The baseline data collection was completed in January 2020 before the COVID-19 pandemic.

2.2. Measurements

The following data are used for analysis:

Socio-demographic data: These comprise age (in years), gender (male/female/neutral), occupational group (practice owner, employed physician, practice assistant), marital status, persons in household over/under 18 years, and care for next-of-kin. The baseline results are published [22].

Work characteristics: The following aspects were assessed—working part-time vs. full-time and number of patients per quarter per practice.

Work-privacy conflict (WPC): WPC was measured using the respective scale of the 2018 German version of the international Copenhagen Psychosocial Questionnaire (COPSOQ III version) [2], which is a validated questionnaire for the measurement of psychosocial factors at work. The WPC scale of this instrument comprises two items ("The demands of my work interfere with my home and family life"; "The amount of time my job takes up makes it difficult to fulfil my family responsibilities") and has a reliability of Cronbach's alpha = 0.92 [2]. The response categories are as follows: strongly agree, somewhat agree, undecided, somewhat disagree, strongly disagree. Following the COPSOQ manual, these were transformed into a numerical scale from 0–100, with high values implying a strong WPC.

Job satisfaction was assessed using the respective scale of the COPSOQ III, which consists of six items: "Regarding your work in general: how pleased are you with: (1) your work prospects? (2) the people you work with? (3) the physical working conditions? (4) the way your group is run? (5) the way your abilities are used? (6) your job as a whole, everything taken into consideration." Participants could choose between the following response categories: very satisfied, satisfied, neither/nor, unsatisfied, highly unsatisfied. Identical to the WPC scale, the answers were transformed into a numerical value from 0–100 and averaged, with high values implying high job satisfaction. Based on Nübling et al. [2]; internal consistency was Cronbach´s alpha = 0.79.

2.3. Statistical Analysis

Standard descriptive methods were applied to analyze all variables respecting their measurement level. Parametric measures, such as mean and standard deviation, are reported to allow for comparability of the results. The standard deviation is based on variance estimation considering the practice clusters. The COPSOQ Scales for WPC and JS were

calculated following the respective manual. Analyses were performed for the whole sample and stratified according to professional group (practice owner, employed physician, practice assistant). Multilevel regression analysis was performed to describe associations between WPC and job satisfaction while respecting the clustered data structure. A hierarchical linear model was calculated to identify factors associated with high WPC, with respect for socio-demographic and work characteristics. The effect size is described by regression coefficients. SPSS Statistics 27 (IBM Cooperation, Armonk, Ny, USA, 2020) and RStudio software were used for statistical analyses. The significance level was set at $p < 0.05$.

3. Results

3.1. Descriptive Results and Demographic Characteristics

A total of 366 participants from 60 practices participated in the study: 112 GPs and GPs in training (84 practice owners, 28 employed physicians) and 254 practice assistants. The gender distribution showed a marked difference between the physicians and the practice assistants: 58.9% were female among the physicians, as were 99.6% of the practice assistants. The mean age of the owners was about 10 and 13.5 years higher, respectively, than that of employed physicians (54.3 vs. 44.8 years) and practice assistants (54.3 vs. 40.9 years). Practice assistants were more likely to work part-time than physicians (58.54% vs. 25%). Details on the socio-demographic characteristics for the total population, stratified by professional groups, are presented in Table 1, as presented in our prior publication [22].

Table 1. Socio-demographic description of participants (baseline), (published in Degen et al. [22]).

	Total Sample	**Practice Owner**	**Employed Physician**	**Practice Assistant**
Variable	N = 366	N = 84	N = 28	N = 254
Female, %	87.1	52.4	78.6	99.6
Age in years, mean (SD)	44.4 (12.8)	54.3 (6.2)	44.8 (9.8)	41.0 (13.0)
Years in current practice, mean (SD)	10.0 (9.1)	15.3 (8.4)	3.9 (5.4)	8.8 (8.9)
Working full time, %	52.0	90.5	28.6	41.5
Living in a relationship/ married, %	78.6	87.8	88.9	74.5
Persons in household over 18 years, mean (SD)	2.2 (1.0)	2.1 (1.0)	2.0 (0.5)	2.2 (1.1)
Persons in household under 18 years, mean (SD)	1.2 (1.0)	1.3 (1.3)	1.4 (1.0)	1.0 (0.9)
Care for next-of-kin, %	20.8	21.7	0.0	22.9
Professional characteristics of physicians (N = 112)				
Years since accreditation as physician, mean (SD)	24 (9.1)	26.6 (7.2)	16.3 (9.7)	-
Years since licensed for the statutory health insurance, mean (SD)	14.5 (9.4)	16.4 (8.4)	5.8 (8.8)	-
Physician in GP training, %	-	-	25.0	-
Professional characteristics of practice assistants (N = 254)				
Years since graduation, mean (SD)	-	-	-	19.9 (13.3)
Qualification as practice assistant, %	-	-	-	81.9
No additional qualification, %	-	-	-	64.2
Practice assistant in training, %	-	-	-	7.5
Average working hours in last 3 months per week, mean (SD)	-	-	-	32.7 (10.7)

3.2. Work-Privacy Conflict

Full-time workers reported higher WPC scores than colleagues working part-time, except employed physicians. Practice owners, employed physicians, and practice assistants differed significantly regarding WPC (F(2.361) = 35.31, $p < 0.001$). Post-hoc tests indicated statistically significant differences between the WPC means of the practice owners and employed physicians and, similarly, the practice owners and practice assistants. Male participants showed significantly higher mean WPC scores than their female colleagues (M = 59.84, SD = 30.82 vs. M = 37.88, SD = 30.64; T(362) = 4.55, $p < 0.001$). Female employed physicians had higher WPC scores than male employed physicians; sub analyses showed higher WPC among part-time working female physicians than males (female part-time: $n = 18$, WPC 49.55; male part-time: $n = 2$; WPC 12.50). For details, see Table 2 and Figure 1.

Table 2. Work-privacy conflict (WPC) scores stratified by various socio-demographic and professional characteristics.

	Mean	SD	Min.	Max.
Occupational group				
Practice owner	64.03	29.96	0	100
male	64.82	27.79	0	100
female	62.35	31.75	0	100
Employed physician *	45.54	30.28	0	100
male	31.25	38.53	0	100
female	49.43	27.41	0	100
Practice assistant **	32.67	28.35	0	100
Gender				
m	59.84	30.82	0	100
f	37.88	30.64	0	100
Age (years)				
<20–29	33.74	28.46	0	100
30–49	37.85	28.82	0	100
50–69	44.62	34.17	0	100
Working part-time				
Total	31.30	27.69	0	100
Practice owner *	43.75	29.12	0	87.50
Employed physician *	45.63	29.88	0	100
Practice assistant	28.53	26.71	0	100
Working full-time				
Total	51.05	31.60	0	100
Practice owner	66.17	29.52	0	100
Employed physician *	45.31	33.37	0	100
Practice assistant	39.74	28.94	0	100
Marital status				
Living alone	40.18	31.75	0	100
In a relationship or married	41.47	31.48	0	100
Taking care of relatives?				
Yes	41.52	32.37	0	100
No	40.57	31.30	0	100

Annotations. * Low case number; model fit does not converge. Values are reported without cluster adjustment. ** Only highly aggregated values are reported in order to maintain identity (low number of male PAs).

3.3. Work-Privacy Conflict and Job Satisfaction

The mean job satisfaction score was 77.16 (SD = 14.30) for GPs in a leadership position ($n = 84$), 79.61 (SD = 12.85) for employed GPs ($n = 28$), and 72.58 (SD = 14.42) for practice assistants ($n = 254$). A more comprehensive and detailed presentation of the descriptive JS scores can be found in Degen et al. [22]. In the multilevel analysis, work-privacy conflict was statistically significantly associated with job satisfaction respecting cluster effects ($b = -0.10$, $SE_b = 0.02$, $t = -4.29$, $p < 0.001$). The negative regression coefficient implies that low WPC scores are associated with higher job satisfaction and reverse. The multilevel regression

analysis showed that being a practice owner or employed physician and working full-time were significantly associated with increased WPC. For details, see Table 3.

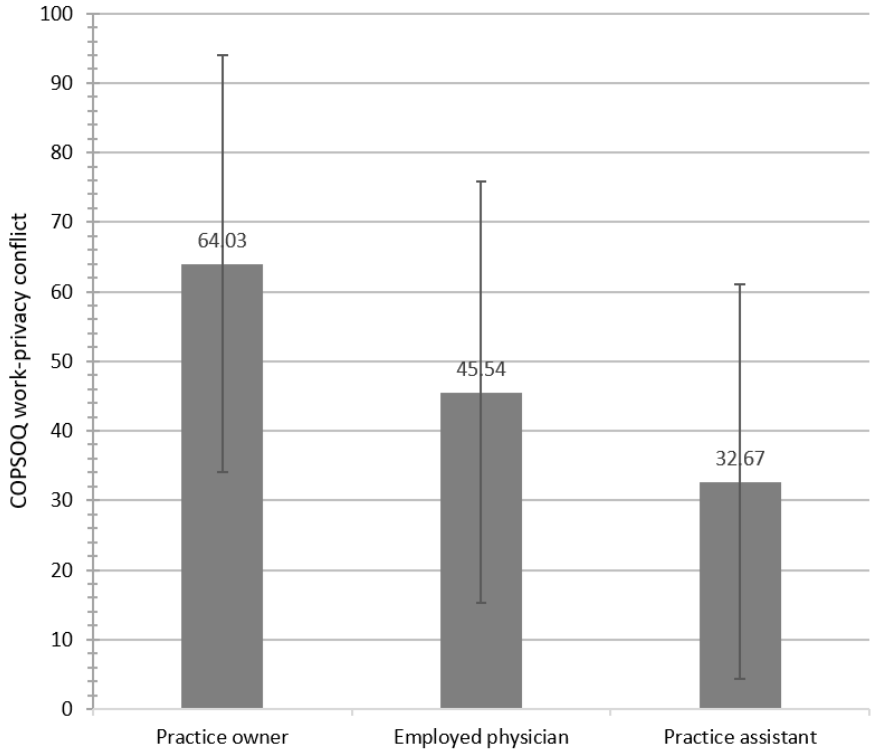

Figure 1. Overview of the COPSOQ work-privacy conflict scores by occupational group (High values imply a strong WPC).

Table 3. Multilevel regression analysis: associations between WPC and socio-demographic, work, and practice characteristics.

	Work-Privacy Conflict		
	b	***SE*$_b$**	***t***
Age	0.13	0.24	1.18
Gender [a]	1.74	7.78	0.22
Marital status [b]	2.71	5.80	0.47
Persons in household over 18 years	0.72	2.04	0.53
Persons in household under 18 years	−0.91	2.05	−0.44
Care for next-of-kin [c]	3.87	5.41	0.71
Occupational group: Practice owner [d]	20.22	8.20	2.47 *
Occupational group: Employed physician [d]	17.98	7.17	2.51 *
Working part-time/full-time [e]	12.15	5.61	2.17 *
Patients per quarter per practice	−0.34	1.00	−0.34

Annotations. * $p < 0.05$, *b*—regression coefficient b; SE_b—standard error; *t*—*t*-value; [a] coded as: 0 = male, 1 = female; [b]: 0 = living alone, 1 = relationship or married; [c]: 0 = no, 1 = yes; [d] Dummy variables for occupational group: 0 = no practice owner/employed physician, 1 = practice owner/employed physician; regression coefficient b shows the expected difference in relation to the reference category practice assistant; [e]: working part-time = 0, working full-time = 1.

4. Discussion

In our study, male and female practice owners showed significantly higher WPC scores than their employed colleagues and practice assistants. This finding aligns with results from the representative, population-based German Gutenberg Health Study of 3709 professionals, which showed higher WPC among academic self-employed professions (physician, attorney, tax consultant; mean WPC women: 43; men: 45) and managers (mean WPC women: 47; men: 45) [6]. However, using the same COPSOQ instrument, the average WPC scores were higher among the physician leaders we studied (total mean: 64.03; women: 62.35; men: 64.82). Our findings are consistent with data from hospital physicians, which showed higher scores on the work interfering with family conflict scale (WIF) than the general population (mean 74 vs. mean 45) [9]. Within our physician population, WPC differed markedly between practice owners and employed physicians (owners: 64.03; employed physicians: 45.54), which is explained by several factors, e.g., a higher workload, existential concerns, and ongoing management issues, in addition to regular patient care. These results align with the findings of Byron, which showed that hours spent at work and self-employment are predictors of work-family conflict [3]. The central role of the hours spent at work as a factor associated with WPC is confirmed in our regression analysis. Participants working full-time reported higher WPC than their colleagues working part-time. In our study, the average part-time hours of work across all occupational groups was 25.89 h/week. PAs who were employed full time worked an average of 40.21 h/week. Based on reliable data from the Central Institute for Statutory Health Insurance in Germany, practice owners reported an average workload of 49.3 h/week [23]. Higher WPC among professionals working full-time was also described in the studies of Byron [3] and Garthus-Niegel [6]. Interestingly, while there is only a small WPC difference between female and male practice owners, WPC was 18 points higher in female than male employed physicians. This is explained by higher WPC scores for part-time working female employed physicians. Their higher scores might be related to engagement in childcare to a larger extend than their male spouses, although this pattern is changing in Germany [24,25]. This finding is interesting, since WPC research has become more important, given a weakening of traditional gender roles [3]. However, our data show much higher WPC among female employed physicians working part-time than their male counterparts. This may reflect a stronger involvement of women in traditional family work.

In a large Canadian 2013 National Physician´s Survey, with more than 5000 family physician participants, 72% were satisfied with their professional lives, while 43.5% were not satisfied with their work-life balance [26]. Although our sample was much smaller, similar results were shown for German practice owners, with a JS score of 77.16 (mean COPSOQ reference population = 63.1 [27]) and a high WPC score of 64.03 (mean COPSOQ reference population = 39.0 [27]). In contrast, data from the German COPSOQ reference population with over 200,000 participants from various occupational groups showed much lower WPC and JS scores [27]. Since the practice owners were older on average, the question arises whether different work values between the generations are responsible for our results. This is consistent with the findings of Twenge et al., who found that younger generations place more value on leisure and extrinsic rewards than do older generations [28].

In the Canadian study, the factors associated with higher JS were a moderate number of working hours per week and having a special focus of interest in their practice [26]. In our sample, a high number of working hours was associated with WPC. Although prospective studies of job satisfaction among German primary care physicians are missing, the comparison with data published by Goetz et al. in 2011, based on 676 German GPs, indicates a rather stable situation: using the Warr–Cook–Wall questionnaire, a JS of 5.56 on a scale from 1 (extremely dissatisfied) to 7 (extremely satisfied) was shown [13].

5. Strengths and Limitations

The participation of complete practice teams, the diversity of practice workplaces, and the comprehensive data collection are the strengths of this study. However, the cross-

sectional nature of the data analyzed does not allow for the analyses of predictors, while longitudinal data is needed to investigate changes over time and approaches for potential prevention.

6. Conclusions

A physicians' job satisfaction influences patients' satisfaction with care [12], as well as the availability of a strong primary care workforce [11,13]. As a theoretical implication of our study, future research should specifically address factors such as strategies to realize well-managed working hours, e.g., by optimizing work processes and the use of delegation models [29]. On a practical level, leadership training for GP practice owners with high WPC values should be implemented to decrease work-privacy conflict, to increase job satisfaction, and to prevent adverse outcomes such as emotional exhaustion [30], burnout [31], and low life satisfaction [32].

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Institutional Review Board Statement: The study complies with the ethical principles of the World Medical Association Declaration of Helsinki. The study was first approved by the Ethics Committee of the Medical Faculty of the University of Bonn (Reference number: 057/19, date of approval: 20/02/2019). In addition, the Ethics Committees of the Medical Association Nordrhein (Lfd-Nr.: 2019107), and of the Medical Faculty, University Hospital of Tuebingen (Project-No.: 446/2019BO2) agreed.

Informed Consent Statement: All participating practice team members received written information and signed informed consent forms, which will be stored at the Institute for General Practice and Family Medicine, University of Bonn.

Data Availability Statement: There are no plans to grant access to full protocol, participant-level datasets, or statistical codes, as data contain potentially identifying information.

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Conflicts of Interest: The authors declare that they have no competing interests.

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3.3 Publication 3

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180° view on general practitioners' leadership skills: practice-level comparisons of leader and staff assessments using data from the cluster-randomised controlled IMPROVE*job* study

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ABSTRACT

Objectives Strong primary care leaders are needed to assure high quality services for patient populations. This study analysed general practitioners' (GP) leadership skills comparing practice-level self and staff assessments based on the full range of leadership model and the leader-member exchange (LMX).

Setting The questionnaire survey was conducted among German general practice leaders and their staff participating in the IMPROVE*job* trial.

Participants The study population comprised 60 German general practices with 366 participants: 84 GP practice leaders and 282 employees (28 physicians and 254 practice assistants).

Primary and secondary outcome measures Leadership skills of the practice leaders were measured using the Integrative Leadership Questionnaire (German Fragebogen für integrative Führung) and the LMX-7 questionnaire. Leaders rated themselves and practice staff rated their leaders. The data was analysed by paired mean comparisons on the practice level.

Results For most leadership dimensions, practice leaders rated themselves higher than their employees rated them. Differences were found for transformational leadership ($p<0.001$, $d=0.41$), especially for the dimensions 'innovation' ($p<0.001$, $d=0.69$) and 'individuality focus' ($p<0.001$, $d=0.50$). For transactional leadership, the dimension 'goal setting' differed significantly ($p<0.01$, $d=0.30$) but not the other dimensions. Scores for negative leadership were low and showed no differences between leaders and employees. Interestingly, employed physicians' rated their practice leaders higher on the two transformational ('performance development', 'providing a vision') and all transactional dimensions. The LMX-7 scale showed high quality relationships between leaders and employees.

Conclusions This 180° analysis of GPs' leadership skills with self and employee ratings indicated good relationships. There is a potential to improve leadership regarding goal-setting, innovation and focusing on individual team members. These results allow for the development of targeted interventions.

Trial registration number German Clinical Trials Register, DRKS00012677. Registered 16 October 2019.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This 180° feedback approach in the general practitioner setting allows for a better understanding of leadership from the perspective of different practice professionals.
⇒ The data reflect a typical spectrum of German general practices with solo and group practices, but results may differ in other settings.
⇒ Leadership teams, not individual leaders, were rated in group practices to capture leadership at the practice level.

BACKGROUND

Strong primary care leaders and a strong primary care workforce are important to assure the health of populations and primary care teams.[1–3] A recent systematic review of 20 studies by Meredith *et al* showed an association between stronger leadership and less burnout among different medical professionals in the USA.[4] In contrast, poor leadership skills have a negative impact on job satisfaction,[5–7] staff well-being[8] and the quality of patient care.[5 9 10] A review showed correlations between better leadership and various quality of care indicators, for example, pain, safety and 30-day mortality.[11] In addition to individual outcomes, leadership is important to promote organisational changes (eg, the

implementation of information technology-supported care).[12]

Scientifically, leadership is conceptualised in several theories. One of the most studied leadership frameworks is the full range of leadership model (FRLM), which integrates transactional, transformational and negative leadership.[13 14] Transactional leadership describes leaders' structuring of work situations, the exchange of contingent rewards (eg, work against salary) and the management by exception.[13–15] In contrast, transformational leadership moves beyond leaders' and staff's self-interests. It focuses on the staff's attitudes and values regarding overarching goals such as self-actualisation, organisational achievements and the well-being of others and society as a whole.[13 14] Building on the FRLM, a recent further development, the so-called Implementation Leadership Scale, focuses on the role of leadership for implementation of organisational changes.[12] Another important leadership theory, the leader-member exchange (LMX), specifically addresses the relationship between leaders and staff. It concentrates on the perceived quality of the dyadic relationship between a staff member and the immediate leader.[13 16] The relationship reflects a dyadic social exchange process ranging from low LMX, described by limited social transactions with more transactional leadership to high LMX, which represents a transformational approach with a high degree of social exchange and a mature leader-member partnership.[16] High-quality relationships positively influence employees' work-related well-being and are associated with higher job satisfaction of healthcare workers.[17]

Based on these theories, various questionnaires were developed, for example, the LMX questionnaire 'LMX-7'[16] and the German questionnaire 'Fragebogen für integrative Führung' (FIF; in English: Questionnaire for Integrative Leadership).[15 18] These instruments allow for a multi-rater perspective: the leader's and the staff's views on the leader's behaviour are measured and compared providing 180° feedback. This method is valuable because assessments from different perspectives create a more comprehensive picture of the leaders' actual skills and performances.[19] Two recent reviews of 60 studies from various medical settings showed that such approaches are increasingly applied in medical education and graduate training,[20 21] but have not been used to evaluate general practitioner (GP) leaders and their teams. Effective interventions to improve leadership were developed and evaluated in the hospital[22] and healthcare management setting.[23] For example, Saravo *et al* showed an improvement in transformational and transactional leadership performance of 57 medical residents in hospital rotations after a 4-week intervention.[22] In addition, a 2018 study from Hill *et al* highlighted positive effects of a leadership training for surgical residents on teamwork and team involvement in decision-making.[24] However, such interventions have not been implemented in German primary care, although high chronic stress and burnout rates are reported for this workforce.[25 26] The need is even larger as about half of the German GPs who mainly work in GP-owned private practices,[27] will reach retirement age in the next 10 years.[28] Based on the leadership frameworks mentioned above, the publicly funded IMPROVE*job* study aimed to improve the job satisfaction of physician leaders and practice personnel of German GP practices focusing on leadership, communication and work processes.[29 30] At baseline, GPs' leadership skills were evaluated comparing GP leaders' self and staff ratings on practice level.

METHODS

This analysis draws on the baseline data of the IMPROVE*job* study, which is designed as a cluster-randomised controlled trial to improve job satisfaction among practice personnel. The details are described in the study protocol.[29]

In short, a total of 60 GP practices in the North Rhine region in Germany were recruited by the Institute of General Practice and Family Medicine of the University of Bonn. The sample comprised single (owned by one practice leader) and group practices (owned by more than one practice leader), some of which were also involved as teaching practices (affiliated to a university). The study aimed to recruit practice teams, including physician leaders, employed physicians and practice assistants. A total of 84 GP practice leaders, 28 employed physicians and 254 practice assistants were recruited. In Germany, primary care is typically provided by GP-owned practices with one to three physicians. For each physician, practices employ about one to two certified practice assistants who finished a vocational training of 3 years. Similar to other regions worldwide, the size of group practices is increasing.

Patient and public involvement

The study did not target patients, but general practice personnel. Therefore, no patients or members of the public were involved.

Ethics

The study was approved first by the Ethics Committee of the Medical Faculty of the University of Bonn (reference number: 057/19, date of approval: 20 February 2019). In addition, the Ethics Committees of the Medical Association North Rhine (Lfd-Nr.: 2019107) and of the Medical Faculty, University Hospital of Tuebingen (project no.: 446/2019BO2) approved the study protocol. The study was performed in accordance with the Declaration of Helsinki. All participating practice team members received study information and signed informed consent forms.

Measures

Practice leaders answered a short questionnaire on practice characteristics and the questionnaire for practice leaders. Employed physicians and practice assistants completed different versions of the same employee

questionnaire. Details of the methods and the characteristics of the study population are published.[29 30]

All participants provided socio-demographic, professional and work-related characteristics which are published.[30] In addition, GP leaders and practice staff filled the following two leadership questionnaires:

Integrative Leadership Questionnaire (FIF)

Transformational, transactional and negative leadership were measured using the FIF questionnaire. Its scales' validity and internal consistency are confirmed for different populations.[18 31] The FIF has been used in non-medical and hospital settings,[32] but not in primary care.

All 40 items of the FIF are answered on a 5-point Likert scale and are worded to reflect either the leader's or the staff's position.

The measures comprise:

- The transformational leadership scale consisting of six dimensions: innovation, team spirit, performance development, individuality focus, providing a vision and being a role model.
- The transactional leadership scale with two dimensions: goal setting and management by exception.
- The negative leadership scale with two dimensions: laissez-faire and destructive leadership.

Leader-member exchange

The relationship quality between leaders and staff is measured using the LMX-7 questionnaire with seven items on a 5-point Likert scale, which are worded to reflect the leader or the staff position.[16 33 34]

The multi-rater, 180° approach is applied to the two leadership scales. Results of such assessments are usually shared with the ratee, yet previous studies showed mixed reactions in the medical setting.[35 36] Therefore, the results of the 180° feedback in our study were not shared with the participating practices but are used on an aggregated level for research purposes only.

Statistical analysis

Statistical analyses were conducted using SPSS Statistics V.27 (IBM, Armonk, New York, USA, 2020). All analyses were carried out at the participant and the practice level.

The FIF data were analysed according to the official manual.[18] Mean scores for transformational, transactional and negative leadership were summarised both for the respective main scale and all dimensions: for transactional and transformational leadership, they ranged from 1 (worst rating) to 5 (best rating); for negative leadership, they ranged from 1 (best rating) to 5 (worst rating). For comparison, scores were standardised using T-scaling tables from reference populations as defined by Rowold and Poethke.[18] These T-values are based on a normal distribution around 50 (SD=10). Thus, values above 70 only reflect about 2% of the reference population from German-speaking countries.[18]

The LMX-7 was analysed per standard protocol by creating a sum score of all seven items without transformation.[34] The LMX-7 score can range from 7 to 35 with five standard categories which were interpreted as follows: score 7–14=very low; 15–19=low; 20–24=moderate; 25–29=high, 30–35=very high.[37] Inadvertently, question seven was missing on all employed physicians' questionnaires, which reduced the answered questions to six. As the LMX-7 manual does not suggest a standard approach for missing values, we excluded employed physicians from the further analyses.

For the 180° feedback approach on practice level, the combined mean scores of employed physicians and practice assistants per practice were compared with the self-assessment of their respective leaders using paired t-tests, as the data satisfied the condition of a normal distribution with the Kolmogorov-Smirnov test. Cohen's d was applied to determine the effect size of mean comparisons with the following standard interpretations: small effects from d=0.2, medium from d=0.5 and high from d=0.8.[38] In single practices, the staff ratings were compared with the leader's assessment. In practices with more than one owner (group practices), each leader's self-rating was compared with the respective ratings of the practice personnel, who were asked to rate the leadership team of the practice, not stratified by individual leaders. This approach was chosen because practice owners of German practices typically work as a leadership team. In addition, the ratings of the transformational and transactional leadership scales were compared stratified by practice type (single vs group and teaching vs non-teaching practices) using the Kruskal-Wallis tests because the data for practice comparisons did not satisfy the conditions for parametric tests.

RESULTS

Population

The baseline data of the IMPROVE*job* study included 366 participants from 60 practices, consisting of 84 practice leaders, 28 employed physicians and 254 practice assistants. The mean age of the participants was 44.4 years, with a mean of 54.3 years for practice leaders, 44.8 for employed physicians and 41.0 for practice assistants. Among the practice assistants, 99.6% were women, as were 76.6% of the employed physicians and half of the practice leaders (52.4%). Most practice leaders worked full-time (90.5%), as did about a quarter of the employed physicians (28.6%) and 41.5% of the practice assistants (see table 1). The details on the socio-demographic descriptions are published.[30]

On average, practice leaders had been accredited for 26.6 years and licensed for the statutory health insurance for 16.4 years. Seven (25%) of the employed physicians were in GP training. Practice assistants had graduated on average 19.9 years ago, while 7.5% were still in training. Of the 60 practices, 21 (35%) were single and 39 (65%) were group practices; of these, 34 were teaching (57%) and 26 (43%) were non-teaching practices. On average,

Table 1 Socio-demographic description of participants at baseline[30]

Variable	Total sample N=366	Practice leaders N=84	Employed physicians N=28	Practice assistants N=254
Female, %	87.1	52.4	78.6	99.6
Age in years, mean (SD)	44.4 (12.8)	54.3 (6.2)	44.8 (9.8)	41.0 (13.0)
Years in current practice, mean (SD)	10.0 (9.1)	15.3 (8.4)	3.9 (5.4)	8.8 (8.9)
Working full-time, %	52.0	90.5	28.6	41.5

practices were in the same location for 20.4 years (SD=14 years).

Leadership

The transactional and transformational leadership scales showed a high internal consistency with Cronbach's α=0.74–0.93 for the staff members' assessment and Cronbach's α=0.72–0.87 for the leaders' assessment. For negative leadership, the scales showed a sufficient internal consistency for staff members' (Cronbach's α=0.73–0.80) but not for leaders' assessments (Cronbach's α=0.47–0.68).

The mean results of the FIF were within the one SD range of the reference population.[18] Based on raw values, employed physicians rated their leaders consistently better than practice assistants and better than the leaders themselves for some items. While practice assistants rated their leaders more poorly than the practice leaders in raw values, reference t-values showed only minor differences. The details are outlined in table 2.

The LMX-7 scale showed an internal consistency of Cronbach's α=0.88 for staff members (practice assistants) and α=0.71 for leaders. Both groups showed a high relationship quality, scoring 28 for practice leaders and 26 for practice assistants. As the seventh question was missing for employed physicians, they were excluded from the analysis. However, the sum score of the remaining six questions also showed a high score of 24.9 out of 30. The details are shown in table 2.

180° leadership feedback

Practice leaders self-rated their leadership skills slightly better than their staff for all dimensions except for 'management by exception'. There were no statistically significant differences for negative leadership. For transactional leadership, goal setting differed significantly with a low effect size (p=0.009, d=0.30). Leaders' scores on transformational leadership were significantly higher than the scores of the teams, with the dimension for innovation reaching the strongest effect size (p≤0.001, d=0.69), followed by individuality focus with a medium effect size (p≤0.001, d=0.50). The scores for team spirit and being a role model were slightly lower, but significant. The

Table 2 Leadership assessment by employment group: main scales (in bold) and dimensions (LMX values can range from 7 to 35, FIF scales from 1 to 5)

	Practice leaders (N=84)				Employed physicians (N=28)				Practice assistants (N=254)			
	M	SD	T*	n	M	SD	T*	N	M	SD	T*	n
Transformational leadership	**3.9**	**0.6**	**45**	**84**	**3.9**	**0.7**	**56**	**27**	**3.5**	**0.8**	**52**	**237**
Innovation	4.2	0.6	49	84	4.0	1.0	55	28	3.7	0.9	52	247
Team spirit	4.1	0.7	49	84	3.8	1.0	54	28	3.6	1.1	52	251
Performance development	3.6	0.8	44	84	4.1	0.7	57	27	3.5	1.0	51	247
Individuality focus	3.9	0.7	47	84	3.7	1.0	54	28	3.5	1.1	53	249
Providing a vision	3.5	0.9	45	84	3.6	0.9	55	28	3.2	1.1	51	245
Being a role model	4.1	0.6	45	84	4.0	0.8	55	27	3.7	1.0	52	246
Transactional leadership	**3.4**	**0.7**	**47**	**83**	**3.5**	**0.7**	**54**	**27**	**3.2**	**0.8**	**50**	**244**
Goal setting	3.5	0.7	44	83	3.7	0.9	56	27	3.1	1.0	50	246
Management by exception	3.3	0.8	51	83	3.4	0.8	52	27	3.3	0.9	51	245
Negative leadership	**1.5**	**0.5**	**51**	**83**	**1.5**	**0.6**	**45**	**28**	**1.7**	**0.7**	**47**	**248**
Laissez-faire	1.6	0.6	52	83	1.6	0.8	45	28	1.7	0.8	46	249
Destructive	1.4	0.5	51	83	1.4	0.6	46	28	1.6	0.7	48	248
LMX-7	**28.1**	**2.6**	–	**81**	**n/a**	**n/a**	–	**n/a**	**26.7**	**4.8**	–	**222**

*Reference t-values range from 0 to 100, as defined by Rowold and Poethke 2017.
FIF, Fragebogen für integrative Führung; LMX, leader-member exchange.

Table 3 Comparison of leaders' self and staff ratings (n=84 leader-team pairs): main scales (in bold) and dimensions

	Practice leaders		Practice staff		Paired t-test		
	M	SD	M	SD	t (df)	P value	d
Transformational leadership	**3.9**	**0.5**	**3.6**	**0.6**	**3.721 (82)**	**<0.001**	**0.41**
Innovation	4.2	0.6	3.8	0.6	6.359 (83)	<0.001	0.69
Team spirit	4.1	0.7	3.8	0.7	3.462 (82)	0.001	0.38
Performance development	3.6	0.8	3.7	0.6	−0.208 (83)	0.836	–
Individuality focus	3.9	0.7	3.5	0.6	4.633 (83)	<0.001	0.50
Providing a vision	3.5	0.9	3.3	0.8	1.592 (82)	0.115	–
Being a role model	4.1	0.6	3.8	0.6	2.833 (82)	0.006	0.31
Transactional leadership	**3.4**	**0.6**	**3.3**	**0.5**	**1.291 (81)**	0.200	–
Goal setting	3.5	0.7	3.2	0.6	2.681 (81)	0.009	0.30
Management by exception	3.3	0.8	3.4	0.6	−0.470 (82)	0.640	–
Negative leadership	**1.5**	**0.4**	**1.6**	**0.4**	**−1.744 (82)**	0.085	–
Laissez-faire	1.6	0.6	1.7	0.5	−1.563 (82)	0.122	–
Destructive	1.4	0.5	1.6	0.5	−1.514 (82)	0.134	–
Leader-member exchange	28.1	2.6	26.8	3.5	3.275 (79)	0.002	0.37

main scale for transformational leadership also showed a significant difference with a medium effect size (p≤0.001, d=0.41). The details are outlined in table 3.

Transformational and transactional leadership by practice type

The Kruskal-Wallis test was applied to analyse for differences in leadership by practice types. It showed slight but non-significant differences in the raw values between practice types (single vs group, teaching vs non-teaching practices), for example, slightly higher ratings for transformational leadership in single and non-teaching practices. These slight differences persisted when using reference t-values. For details, see table 4.

DISCUSSION

Using a 180° feedback approach of leadership in GP practices, this study showed good relationships between leaders and staff with low levels of negative leaderships. Practice staff rated their leaders slightly higher on all transformational and transactional dimensions than the 234 German leaders and 713 employees from the FIF questionnaire reference population.[18] Also, agreement between GP leaders and staff was higher than in a study of 1137 German hospital employees (315 leaders, 822 staff members) from different occupational groups (eg, physicians, nurses, administration, information technology), which used the same methodology.[32] Interestingly, hospital and GP leaders rated themselves approximately similar.[32]

Table 4 Comparison of leadership assessments by practice type: single versus group practices and teaching versus non-teaching practices

	Single (n=21)			Group (n=39)			Non-teaching (n=26)			Teaching (n=34)		
	M	T	n	M	T	N	M	T	n	M	T	n
Practice leaders												
Transformational	4.0	47	21	3.9	45	63	3.8	43	37	4.0	47	47
Transactional	3.4	47	21	3.4	47	62	3.3	45	37	3.4	47	46
Negative	1.5	51	21	1.5	51	62	1.6	53	37	1.5	51	46
LMX-7	28.8	–	20	27.9	–	61	27.5	–	36	28.6	–	45
Practice staff												
Transformational	3.7	54	67	3.6	53	212	3.5	52	117	3.6	53	162
Transactional	3.4	53	67	3.3	51	212	3.3	51	117	3.2	50	162
Negative	1.7	47	70	1.7	47	212	1.7	47	117	1.6	46	165
LMX-7	27.5	–	61	26.3	–	190	25.6	–	105	27.3	–	146

LMX-7, leader-member exchange.

The benefit of 180° and 360° feedback is shown in studies from various settings. In a sample of more than 2000 US military leaders, 360° feedback (leaders, subordinates, peers) was identified as a good predictor for promotions.[39] This is in line with a 180° feedback (leaders, employees) study among 396 managers from different departments of an international airline: congruence between managers self-ratings and employees ratings predicted managerial behaviour such as innovation, decision-making, leading and motivation.[40] In a sample of 1190 physicians from the USA and Canada, the 180° feedback approach, which is also called multi-rater assessment, provided a more realistic picture of leader-team situations as shown by an improvement in a leadership teamwork index.[36] In our study, leadership ratings of employed physicians were markedly higher in most dimensions than those by non-physician practice personnel. This likely reflects that employed physicians are much closer to their physician leaders regarding training, roles and duties compared with practice assistants. In addition, practice assistants do not have the perspective to become physician leaders themselves, which implies a fundamentally different perspective. This finding is in line with a 2010 review identifying several studies which showed that staff members who perceive themselves as more similar to the leader give better performance ratings.[41] This effect was shown, for example, among 406 rater and 396 ratees in an insurance company.[42]

Multi-rater assessments can provide the basis for analysing and at best improving the psychological well-being at workplaces by a better mutual understanding of leaders and staff.[7 41 43] A 2016 study of 110 insurance managers and their teams showed higher job satisfaction with higher mutual ratings. Job satisfaction among employees (assessed on a 1–5 scale) was lowest when leaders rated their leadership skills higher than their subordinates did (mean 3.89 of 5 compared with 4.53 of 5 in agreement).[44] Rowold and Poethke who developed the FIF questionnaire conclude from their studies that leaders can learn to adapt when receiving the leadership ratings as feedback. In addition, they recommend implementing, for example, regular team meetings and improving leadership skills through training.[18] Results from the DIALHS (District Innovation and Action Learning for Health Systems Development) collaboration from South Africa point at the need for accountability strategies such as standard operating procedures, facility audits and target setting.[45] While other studies followed this approach to share the assessment results with the ratee, we abstained from this because previous studies in the medical field showed mixed reactions. In a 2005 study, 15 family physicians rated multisource feedback extremely different, from negative to positive. This evaluation was affected by the perceived usefulness, accuracy and credibility.[35]

Using the LMX questionnaire, a 2008 study with 200 nurses from six smaller and larger hospitals showed positive associations of high mutual relationship scores with enhanced commitment, reduced staff turnover and better organisational behaviour.[46] Also, positive effects on employees' health and well-being are described in association with good relationships between leaders and employees. Lower levels of emotional exhaustion were associated with higher leader-member exchange quality in a sample of 343 employees working in the German healthcare sector after 11 months.[47] In addition, a hierarchical regression model showed that the LMX was a good predictor for the health of 412 employees in health and social services in Germany.[48] Compared with the LMX reference values based on 113 participants, our study showed an overall better relationship quality between practice leaders and practice assistants (mean value of 28.1 of 35 for practice leaders and 26.8 for practice assistants vs 22.9 in the LMX reference population).[34] Higher scores in the practice setting are likely influenced by the fact that GP leaders recruit personnel themselves, while personnel recruitment and placement in larger institutions is not necessarily in the hands of the direct team leaders.

Strengths and limitations

Novel for the German GP setting, we investigated GP leadership in a large sample with analysis on practice level. Our data provide leadership ratings for each solo practice leader, but not for each group practice leader, as we had asked staff to rate their leadership team to reflect current small team leadership situations. LMX data were missing for one of seven questions for the small number of employed physicians. However, the analysis of the available data yielded a high relationship quality with leaders like the results for practice assistants. A selection bias cannot be excluded as participating practices might have had a greater interest in the topic.

Conclusion and practical implications

Overall, our data from the IMPROVE*job* study show trustful relationships between GP leaders and their staff. Future GPs' training should enable GP leaders to implement goal-setting, innovation and individuality focus more effectively. Our results support recent calls for leadership workshops on every level of the medical training for strengthening the GP and other health services workforce.

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3.4 Publication 4

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Leadership program with skills training for general practitioners was highly accepted without improving job satisfaction: the cluster randomized IMPROVE*job* study

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Leadership has become an increasingly important issue in medicine as leadership skills, job satisfaction and patient outcomes correlate positively. Various leadership training and physician psychological well-being programmes have been developed internationally, yet no standard is established in primary care. The IMPROVE*job* leadership program was developed to improve job satisfaction among German general practitioners and practice personnel. Its acceptance and effectiveness were evaluated. The IMPROVE*job* intervention is a participatory, interdisciplinary and multimodal leadership intervention that targets leadership, workflows and communication in general practices using three elements: (1) two leadership workshops with skills training; (2) a toolbox with printed and online material, and (3) a 9-month implementation phase supported by facilitators. A cluster-randomised trial with a waiting-list control evaluated the effectiveness on the primary outcome job satisfaction assessed by the Copenhagen Psychosocial Questionnaire (range 0–100). A mixed-methods approach with questionnaires and participant interviews evaluated the acceptance of the intervention and factors influencing the implementation of intervention content. Statistical analyses respected the clustered data structure. The COVID-19 pandemic necessitated intervention adjustments: online instead of on-site workshops, online material instead of facilitator practice visits. Overall, 52 of 60 practices completed the study, with altogether 70 practice leaders, 16 employed physicians, and 182 practice assistants. According to an intention-to-treat analysis, job satisfaction decreased between baseline and follow-up (not significantly) in the total study population and in both study arms, while the subgroup of practice leaders showed a non-significant increase. A mixed multilevel regression model showed no effect of the intervention on job satisfaction ($b = -0.36$, $p > 0.86$), which was influenced significantly by a greater sense of community ($b = 0.14$, $p < 0.05$). The acceptance of the IMPROVE*job* workshops was high, especially among practice leaders compared to assistants (1 = best to 5 = worst): skills training 1.78 vs. 2.46, discussions within the practice team 1.87

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vs. 2.28, group discussions 1.96 vs. 2.21. The process evaluation revealed that the COVID-19 pandemic complicated change processes and delayed the implementation of intervention content in practice routines. The workshops within the participatory IMPROVE*job* intervention were rated very positively but the multimodal intervention did not improve job satisfaction 9 months into the pandemic. Qualitative data showed an impairment of implementation processes by the unforeseeable COVID pandemic.

Trial registration Registration number: DRKS00012677 on 16/10/2019.

In the last decades, leadership has become an increasingly important topic in medicine, with the need to especially train physician leaders[1,2]. In graduate education, the 'physician as leader' is conceptualized in the CanMEDS roles, but no standard for leadership training in primary care and other specialties has been developed[3,4]. Four reviews comparing various leadership programs showed considerable diversity regarding target groups (physicians of various experience levels), specialty focus (primary care and other fields), program aims (e.g., clinical leadership for integrated primary care), theoretical foundation and methodological approaches (scoping, narrative vs. systematic reviews)[4–7].

All reviews mentioned describe leadership as a dynamic process between persons that is oriented towards individual, group or organizational goals and is associated with influence[4]. Previous leadership programs drew on different theories, e.g., transformational and transactional leadership as frequently used modern concepts[4–7]. Transactional leadership is based on a mutual exchange between leader and employees (e.g., rewarding previously negotiated objectives)[8], while transformational leadership addresses the leader's promotion of intrinsic motivation and communication of vision[9]. Both theories are well-studied, established and complement each other theoretically and in practice[4]. Methodologically, the reviewed interventions combine various learning methods, e.g., seminars, lectures, group work, mentoring, multi-source and action-based feedback. A 2014 review by Frich et al. identified 12 programs which involved the use of simulation exercises (simulated practice and/or role-play)[6]. Of these, six interventions improved outcomes on the system level, e.g., staff-reported quality of care, participant career success, improvements of disease management programs, and customer satisfaction[6]. Drawing on various occupational fields, a meta-analysis by Judge and Piccolo showed that employees' job satisfaction correlates positively with transformational leadership ($\rho = 0.58$) and contingent reward leadership as a dimension of transactional leadership ($\rho = 0.64$)[10]. However, the authors of many reviews agree, that more rigorous research on leadership and leadership training measured by relevant subjective and objective outcomes is needed[4–7].

A study with more than 200,000 German professionals from the hospital setting and other occupational fields highlighted the importance of leadership as the most important predictor of job satisfaction[11], which in turn was deeply linked to work-related factors such as workload, team support, recognition, bureaucracy, and income in European general practitioner (GP) populations[12,13]. Also, job satisfaction was associated with emotional exhaustion and stress related to patient care[14]. Interventions to optimize job satisfaction showed mixed results. A 6-month professional coaching of 88 physicians, including family physicians, improved quality of life and resilience while reducing emotional exhaustion and burnout rates, yet job satisfaction did not change[15]. Job satisfaction among 45 Spanish GPs improved after participating in a multimodal training program with an integrated systemic therapy approach[16]. While job satisfaction was widely studied in GP populations, intervention studies addressing leadership and job satisfaction in this setting are missing.

The IMPROVE*job* intervention conceptualized a participatory, interdisciplinary and multimodal leadership program for GPs to improve job satisfaction. It drew on the transformational and transactional leadership theories as well as the leader member exchange theory[17]. Using innovative skills trainings, the intervention aimed at practice-relevant leadership skills[18,19]. The effectiveness of the IMPROVE*job* leadership program on job satisfaction of GP practice leaders and practice personnel and its acceptance were evaluated in a cluster-randomized controlled trial.

Methods

Study design, sample size and randomisation. The IMPROVE*job* study evaluated the effectiveness of the IMPROVE*job* intervention on job satisfaction among practice leaders and practice personnel. It was conducted as a cluster-randomised controlled trial (cRCT) with a waiting-list control group, i.e., control group participants received the intervention after follow-up data collection (see Fig. 1). After baseline data collection, the practices were randomised to the two study arms with the intervention group receiving the intervention lasting 9 months. All participating practices were recruited in the Greater Bonn/Cologne region of North-Rhine Westphalia, Germany. According to the sample size calculation, we targeted a total of 56 practices with an average of 4 participants per practice for recruitment, allowing for 2 dropouts in each study arm (for details see[18]). The randomisation was carried out by the Centre for Clinical Trials Essen after baseline data collection. The randomisation was stratified for (a) single versus group practice and (b) teaching versus non-teaching practice.

Inclusion and exclusion criteria. We included practices if the practice leader was registered as a general practitioner of the Association of Statutory Health Insurance Physicians of North-Rhine and/or belonged to the teaching physician network of the University of Bonn or Cologne. We excluded practices if they were in extraordinary situations such as an upcoming retirement of the leader. In addition, we excluded any practices that had participated in the development of the IMPROVEjob intervention or the feasibility study of the intervention.

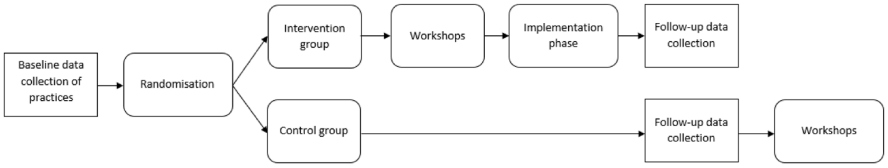

Figure 1. Study design[18].

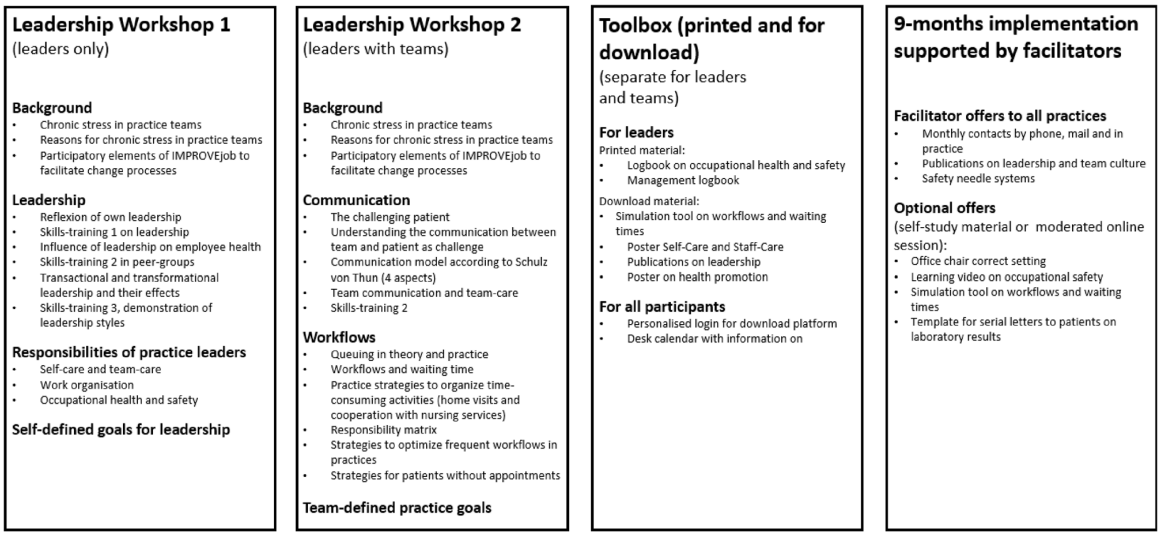

Figure 2. Elements of the IMPROVE*job* intervention[(25, p. 5)].

Informed consent, data collection and outcome measures. All participants provided written informed consent. Data collection took place before randomisation and 9 months after the intervention.

The primary outcome of the IMPROVE*job* study was a change in job satisfaction, measured with the German version of the Copenhagen Psychosocial Questionnaire (German COPSOQ, Version 2018). The respective job satisfaction scale combines five items and an additional global item ('How pleased are you with your job as a whole, everything taken into consideration?') using a 5-point Likert scale and were transformed to a score ranging from 0 ('not satisfied at all') to 100 ('fully satisfied') based on the COPSOQ guidelines[20].

The questionnaire comprised various secondary outcomes which are detailed in the published study protocol[18]. Of these, we used the following measurements for the analyses presented here: COPSOQ scales 'social support' (B8: 1–4) and 'sense of community' (B8: 8–9). The scores for each dimension were transformed as recommended, ranging from 0 (minimum value, 'do not agree at all') to 100 (maximum value, 'fully agree')[20,21]. Leadership was assessed using the questionnaire on Integrative Leadership (FIF, Fragebogen zur Integrativen Führung)[22]. We used the six dimensions of transformational leadership (fostering innovation, team spirit development, performance development, individuality focus, providing a vision, being a role model) and the two dimensions of transactional leadership (goal setting, management by exception)[22,23]. The workshops and the specific contents of the intervention were assessed at follow-up using an adapted scale based on the German school grading system (1 = best to 5 = worst).

Process analysis by qualitative interviews addressing factors influencing implementation. After the 9-month implementation phase, semi-structured qualitative interviews were conducted with four practice leaders and three practice assistants from the intervention group by phone (n = 4) and face-to-face (n = 3). The interviews were transcribed and analysed by qualitative content analysis[24]. The interview guide addressed the following topics: planned and actual changes in the practices after workshop participation, facilitators and barriers to change processes and experiences with the IMPROVE*job* facilitators.

Intervention. The IMPROVE*job* intervention consisted of three core elements (see Fig. 2):

(1) Two IMPROVE*job* leadership workshops (3.5 h each): one for practice leaders (practice leaders and physicians with leadership responsibilities) and one for the practice leaders and their teams,

(2) The IMPROVE*job* toolbox with additional materials, and
(3) The 9-month implementation phase supported by IMPROVE*job* facilitators.

The two intervention workshops for each practice took place between November 2019 and August 2020 and were conducted with an interval of 2 weeks. Depending on availability and practice size, a total of 3 to 6 practice teams took part in each workshop.

The workshops were led by one of two academic primary care physicians and included presentations by the researchers from the various fields in addition to interactive elements, self-reflection, peer exchange, and several leadership skills training sessions supported by simulation patients. All skills training sessions were based on a fictional scenario confronting the participants with situations challenging their individual leadership skills. Leadership workshop 1 for physician leaders and physicians with leadership responsibilities addressed the topics 'role of the executive', 'leadership styles' and 'occupational health and safety for GP practices' in theory and practice. The first skills training sessions in leadership workshop 1 addressed the scenario of a leader confronted with a conflict between practice team members. The second skills training was a presentation by the research team on a fictitious team session to illustrate various aspects of transformational and transactional leadership.

Leadership workshop 2 for physicians with leadership responsibilities and their practice teams concentrated on 'work organisation including appointment scheduling', 'workplace health promotion' and 'communication with patients'. Further skills training sessions (two for the practice assistants, one for the practice leaders) addressed communication with challenging patients. In addition, this workshop focussed on the practice team to analyse common workflows and integrate optimized procedures into the practice workflow.

The IMPROVE*job* toolbox comprised printed and online material which was introduced in the workshops: The 'management logbook' for physicians with leadership responsibilities, the 'employee logbook', the desk calendar for practice teams and additional material for downloading.

The 9-month implementation phase, supported by IMPROVE*job* facilitators, began after leadership workshop 2. The two facilitators were trained practice assistants with profound professional experience who assisted the practices during the change processes. The facilitators' main tasks were to remind the practice of the IMPROVE*job* study, the self-defined practice goal, and to offer additional toolbox material.

Changes of the study protocol and study conduct due to the COVID-19 pandemic. The first lockdown in the COVID-19 pandemic started in March 2020 during the intervention phase and required the following changes:

1. Online instead of on-site workshops: Except for one, all workshops of the intervention group were conducted on-site prior to the pandemic. The remaining on-site workshop was split into five online sessions due to organizational reasons. All control group workshops were shifted to the online format.
2. Adaptation of workshop content for the online format: The workshop duration was reduced from 3.5 to 2 h with some educational material being shifted to the toolbox. The skills training sessions with simulation patients were continued but modified to allow for an online format.
3. Written and online offers instead of practice visits in the implementation phase: Due to contact restrictions, facilitators were unable to perform practice visits. Practices received monthly facsimiles with educational material, phone calls and offers for videos and/or online sessions on various topics.
4. For n = 11 busy practices that were unable to complete the follow-up questionnaire, a one-page option covering only the main outcome job satisfaction was offered.

Statistical analysis and ethics statement. We used standard statistics for a multilevel description of the sample and the various items respecting the clustered data structure. Following our study protocol, we calculated all standardized scales following the recommendations of the respective scales[18]. Multilevel regression analyses were performed to compare the change in job satisfaction between baseline and follow-up in the intervention and the control group (primary outcome). In addition, according to results from recent literature[11] we analysed for associations between the change in job satisfaction assessment (difference between baseline and follow-up) and sociodemographic data (age, gender, occupational group and working full-time) as well as the secondary outcomes transformational and transactional leadership scores, social support and sense of community at follow-up. All regression analyses respected the clustered data structure. The additional evaluation of the intervention elements used a 5-point Likert scale linked to the German school grading system (1 = best/very satisfied to 5 = worst/very unsatisfied). SPSS Statistics 27 (IBM Corporation, 2020), SAS 9.4 and RStudio were used for statistical analyses. The significance level was set at $p < 0.05$. Results are reported according to the CONSORT 2010 checklist of information to include when reporting a randomised trial (see Additional File 1).

The study was first approved by the Ethics Committee of the Medical Faculty of the University of Bonn (reference number: 057/19, date of approval: 20 February 2019).

Ethics approval and consent to participate. The study complies with the ethical principles of the World Medical Association Declaration of Helsinki. The study was first approved by the Ethics Committee of the Medical Faculty of the University of Bonn (reference number: 057/19, date of approval: 20/02/2019). In addition, the Ethics Committees of the Medical Association of North-Rhine (ref. no.: 2019107), and of the Medical Faculty, University Hospital of Tuebingen (Project No.: 446/2019BO2) approved the study protocol. All participants provided written informed consent before participating in the study.

Variable	Total sample N = 268	Practice leader N = 70	Employed physician N = 16	Practice assistant N = 182
Female, %	85.4	51.4	68.8	100.0
Age in years, mean (SD)	45.5 (12.3)	53.6 (5.9)	47.2 (9.9)	42.2 (12.8)
Years in current practice, mean (SD)	12.5 (9.2)	16.56 (8.1)	8.4 (6.9)	11.12 (9.2)
Working full-time, %	54.8	90.0	37.5	42.3
Living in a relationship/married, %	81.5	88.2	93.8	77.9
Persons in household over 18 years, mean (SD)	2.1 (0.9)	2.09 (0.9)	2.07 (0.5)	2.15 (0.9)
Persons in household under 18 years, mean (SD)	1.1 (1.0)	1.2 (1.2)	1.2 (1.1)	1.1 (0.9)
Care for next-of-kin, %	27.4	35.8	15.4	25.7
Professional characteristics of physicians (N = 86)				
Years since accreditation as physician, mean (SD)	25.6 (8.3)	27.1 (8.1)	19.4 (10.4)	–
Physician in GP training, %			37.5	
Number of patients in 3 months, %				
< 750	25.0	22.9	35.7	
751–1000	28.6	28.6	28.6	
1001–1250	23.8	22.9	28.6	
> 1250	22.6	25.7	7.1	
Professional characteristics of practice assistants (N = 182)				
Years since graduation, mean (SD)				22.0 (13.5)
Qualification as practice assistant, %				83.4
Practice assistant in training, %				7.1
Average working hours in last 3 months per week, mean (SD)				31.0 (89.0)

Table 1. Sociodemographic characteristics of the participants who completed follow-up (n = 268).

	Study arm	Baseline Mean (95% CI)	Follow-up Mean (95% CI)	Change from baseline to follow-up Mean (95% CI)
Total study population	Intervention (n = 129)	73.41 (70.24 to 76.58)	71.95 (68.07 to 75.83)	− 1.31 (− 4.13 to 1.50)
	Control (n = 139)	75.19 (72.00 to 78.39)	74.06 (70.10 to 78.02)	− 0.96 (− 3.77 to 1.85)
Subpopulations				
Practice leader	Intervention (n = 37)	74.37 (69.24 to 79.51)	79.46 (75.45 to 83.46)	5.78 (0.86 to 10.70)
	Control (n = 33)	79.85 (74.40 to 85.31)	83.08 (78.79 to 87.37)	359 (− 1.62 to 8.80)
Employed physician*	Intervention (n = 5)	79.17 (68.78 to 89.55)	74.17 (59.06 to 89.27)	− 5.00 (− 20.3 to 10.27)
	Control (n = 11)	77.65 (70.65 to 84.65)	80.23 (70.04 to 90.41)	2.87 (− 7.92 to 13.67)
Practice assistant	Intervention (n = 87)	72.65 (68.55 to 76.74)	68.43 (63.58 to 73.28)	− 4.01 (− 7.31 to − 0.71)
	Control (n = 95)	73.44 (69.35 to 77.53)	70.36 (65.49 to 75.24)	− 2.97 (− 6.22 to 0.29)

Table 2. Intention-to-treat analysis: multilevel regression analyses for the primary outcome job satisfaction for total sample and by professional groups (stratified by study arm) (n = 268). *Low case number; model fit does not converge. Values are reported without cluster adjustment.

Results

A total of 52 practices with 268 participants (intervention group = 129, control group = 139) completed the study: 70 practice leaders, 16 employed physicians and 182 practice assistants. The drop-out comprised 8 practices ($n = 98$ participants) with 14 practice leaders, 12 employed physicians and 72 practice assistants, $n = 53$ of whom from the intervention group and n = 45 from the control group. There were no statistically significant differences for gender, working full-time, job satisfaction and chronic stress at baseline between individuals with and without a follow-up, while the mean age differed (45.5 [with follow-up] vs. 41.4 years [only baseline]). At follow-up, 23 participants from 11 practices completed the short questionnaire (8.6%): 12 practice leaders, 1 employed physician and 10 practice assistants.

The leaders more frequently worked full-time and had been in their current practice for longer. About half of the leaders were female (51.4%), as were all practice assistants. Of the non-physician personnel, 83.4% were certified practice assistants, while 7.1% were still in training (see Table 1).

As detailed in Table 2, the mean job satisfaction of the practice leaders increased from baseline to follow-up, while it decreased among practice assistants.

In the intention-to-treat analysis for the primary outcome, the multilevel regression model estimated an effect size of − 0.36 (CI 95%: − 4.34 to 3.62; p = 0.86).

	Difference in job satisfaction between baseline and follow-up		
	b	SEb	t
Age	0.28	0.07	**3.78*****
Sex	−2.22	2.83	−0.79
Working time	−2.25	1.83	−1.23
Practice owner	−1.15	3.05	−0.38
Employed physician	−0.33	3.26	−0.10
Social support	−0.01	0.05	−0.23
Sense of community	0.14	0.05	**2.67****
Transformational leadership	2.19	1.42	1.54
Transactional leadership	1.38	1.31	1.06
Intervention	1.91	1.67	1.15

Table 3. Mixed model on the difference in job satisfaction between baseline and follow-up (model 1). *p < 0.05, **p < 0.01, ***p < 0.001, *b* regression coefficient b, *SEB* standard error, *t* t-value, a coded as 0 = male, 1 = female, b coded as 1 = yes, 0 = no. Significant values are in bold.

	Total sample (n = 129)		Practice leader (n = 37)		Employed physicians (n = 5)		Practice assistants (n = 87)	
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)
Skills trainings	84	2.24 (0.79)	23	1.78 (0.80)	4	1.75 (0.96)	57	2.46 (0.68)
Discussions within the practice team	88	2.16 (0.81)	23	1.87 (0.81)	4	2.00 (0.82)	61	2.28 (0.80)
Group discussions	90	2.13 (0.74)	24	1.96 (0.81)	4	2.00 (0.82)	62	2.21 (0.70)
Presentations	88	2.17 (0.68)	24	2.04 (0.69)	4	2.00 (0.82)	60	2.23 (0.67)
Exchange with colleagues	89	2.13 (0.79)	24	2.08 (0.83)	4	1.75 (0.96)	61	2.18 (0.76)
Self-reflections	85	2.34 (0.73)	23	2.22 (0.85)	4	2.00 (0.82)	58	2.41 (0.68)
Overall project	98	2.55 (0.96)	25	2.32 (1.11)	4	2.50 (0.58)	69	2.64 (0.92)
Workshop 1 (leaders only)	22	1.95 (1.00)	22	1.95 (1.00)	–	–	–	–
Workshop 2	90	2.49 (0.94)	21	2.14 (1.01)	3	2.33 (0.58)	66	2.61 (0.91)

Table 4. Evaluation of the workshop elements by the intervention group at follow-up (total and stratified by profession) using a five-point scale (1 = very satisfied/best to 5 = very unsatisfied/worst).

In a multilevel regression model, age ($t = 3.78$, $b = 0.28$) and sense of community at follow-up ($t = 2.67$, $b = 0.14$) were found to significantly influence the change in job satisfaction between baseline and follow-up, while the study arm and the other variables had no significant influence. For details see Table 3.

Evaluation of the workshops and workshop contents. The workshops were rated by 25 of 37 (67.6%) practice leaders, 4 of 5 (80%) employed physicians and 69 of 87 (79.3%) practice assistants. The evaluation of the workshops, performed on an individual level, showed that the workshops were rated well. The highest ratings were given by physician leaders: skills training (mean 1.78), group discussions (mean 1.96), and discussions within their own practice team (mean 1.87) (for details see Table 4 and Fig. 3).

Content analysis of practice leaders' and practice assistants' interviews. In addition to the quantitative evaluation, we conducted a total of seven structured interviews with 4 practice leaders and 3 practice assistants from 4 intervention practices. The main results of the content analysis are summarized here.

We identified eight common themes in the data: (1) strain due to the COVID-19 pandemic, (2) changes in working conditions and operational procedures, (3) project-related benefits, (4) changes in attitude, (5) persisting problems, (6) suggestions for improvement, (7) promoting factors for implementation, (8) barriers to implementation.

In all interviews, the COVID-19 pandemic was mentioned as the main barrier to implementation. New COVID-19-related (hygiene) regulations and documentation requirements, personal protective equipment procedures and patient management made the job even more challenging. During the 9-month implementation phase, this additional, pandemic-related workload profoundly impaired the implementation of strategies to achieve the practice goals. The frequently changing workplace requirements, new regulations, protective procedures for the practice team, increasing bureaucracy, and the pandemic-related additional workload with increasing hygiene requirements, coordination of appointments and changing administrative processes impaired the implementation of strategies to achieve the practice goals agreed upon in the intervention workshops.

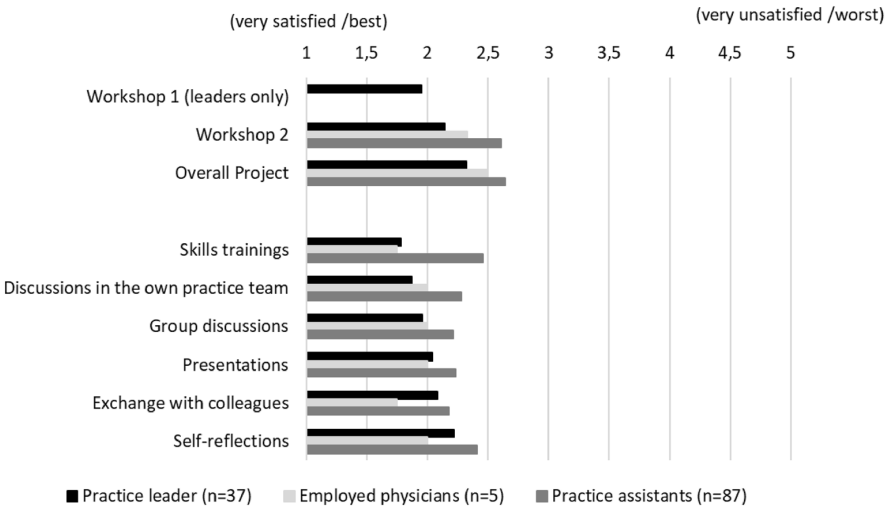

Figure 3. Evaluation of the intervention elements.

The challenge of staying focussed on the goals due to the overall workload was reported as a persistent problem. Actual barriers to implementation included a shortage of staff and lack of time. Interviewees reported changes in some working conditions and operational procedures as presented in the workshops, resulting in improved communication within the team and with the patients. As a result of the skills training in the intervention workshops, participants mentioned a change in attitude towards patients, a questioning of current modes of operation and an increased awareness for change processes.

The results highlighted the following project-related promoting factors for implementation: the motivation for self-reflection, a regular exchange with other teams and the interaction with colleagues, the skills training, and practical demonstrations in the workshops. The interviews revealed some suggestions for improvement: practice assistants wanted less theoretical content, but more skills training. Also, encouragement for self-reflection in the workshops and more intensive on-site coaching were considered useful for future projects.

Discussion

The innovative skills training-based IMPROVE*job* workshops were very well accepted by general practice leaders and their teams. Yet, the multimodal intervention had no effect on job satisfaction 9 months into the unforeseen COVID-19 pandemic which markedly impaired implementation processes. Several aspects need to be discussed to better understand the study results.

In medical education, mainly procedure-oriented leadership training is well established in the context of emergency, intensive care medicine and resuscitation, using standardized simulation exercises to train for the management of clearly defined clinical scenarios[26]. Focusing on interprofessional communication as a broader aim, surgical residents are trained by means of lectures, simulation exercises and scenarios[27]. As outlined in the reviews mentioned above, most current leadership training in medicine fails to address leadership as a broader topic and is not theory-based[3,6,7]. In human resource management research, a theory-based, long-term leadership development program with 25 leaders of a drug development corporation showed significant improvements in transformational leadership after five 2-day training sessions[28]. Based on such research from outside the field of medicine, Saravo et al. conducted a 4-week, on-the-job leadership training with skills training for medical residents addressing transformational and transactional aspects. In self- and observer ratings, the intervention group showed a significant improvement in both transformational and transactional leadership performance in the clinical setting[19]. Drawing on these successful experiences, the IMPROVE*job* leadership programme combined small group seminars with theoretical input on leadership, skills training and peer exchange to improve leadership among general practice leaders. This practice-oriented, theory- and skills training-based leadership program is a novelty that was widely accepted and rated well even by practice leaders with more than 20 years of experience as a physician.

With leadership as the most important predictor of job satisfaction[11], the IMPROVE*job* study aimed to improve job satisfaction of general practice teams but was not successful in doing so 9 months into the pandemic. Several aspects might have played a role in this. First, our participants already showed a high level of job satisfaction at baseline, especially within the subgroups of practice leaders and employed physicians (COPSOQ 77.2 and 79.6; scale 0 to 100). The scores in our total sample were higher than the 2021 data of the COPSOQ databank with more than 200,000 participants from various occupational fields (74.19 vs. 63.1 of 100[11]). This is in line with prior research[29] and makes interventions to improve job satisfaction more difficult. In contrast to other occupational groups[30], our baseline data showed the interesting combination of high job satisfaction together with a high burden of chronic stress[25]. This finding of high chronic stress is in line with prior research[31].

Second, the early phase of the COVID-19 pandemic with its lockdowns and profound burden on primary care practices negatively impacted the 9-month implementation phase in two ways: Effective facilitator support was barely possible, and—most important as shown in the qualitative interviews—practices were extremely busy with COVID-19-related patient management, with no time for additional change processes geared at achieving their practice goal. Third, the profound impact of the COVID-19 pandemic on practices from both study arms likely outplayed any changes in the intervention group. This assumption is supported by the process evaluation and the finding that job satisfaction among leaders in the intervention group improved more than that among leaders from the control group, although significance was not reached when comparing the small subsamples. Fourth, change processes that rely on individual motivation and commitment[32,33] need time, especially if they involve a complex setting such as a practice. Leaders who were likely more motivated than practice assistants received a higher intervention dose as they participated in two workshops. This may have resulted in earlier mental change processes on behalf of the leaders, while the 9-month implementation phase likely was too short for changes of complex practice environments, especially within the scope of the pandemic. Supported by the theoretical framework of transfer training by Baldwin et al. several months are needed before subordinates may detect changes in leaders' behaviors, with the exact mechanisms and time frames being unknown[28,34]. Although transformational leadership is positively associated with a readiness to change[35], high levels of occupational stress are negatively associated with attitudes and commitment towards change processes[36], which played a major role in our practices in the face of the pandemic. Thus, the decrease in job satisfaction among practice assistants of our study might be attributable to a less transformational and more transactional leadership style to address the pandemic needs.

Our multilevel regression model on parameters that predict a change in job satisfaction identified higher age and a greater sense of community at follow-up as significant factors with relevance in both study arms. These findings are supported by Swedish research from successful change processes in intensive care units which identified five factors as relevant to integrating whole teams into team change processes: staff´s ownership of the change process; management has the role to initiate, coach and support the processes; team communication on values and norms; generous time allowance as the change processes take time; and room for re-evaluation[37]. A Polish study showed that good relations with trust among colleagues and to the supervisors are strongly associated with job satisfaction[38], especially in the era of COVID-19 and the associated challenges.

Strengths and limitations. The IMPROVE*job* study was a new approach to improve job satisfaction using a structured leadership intervention for the general practice setting. The cluster-randomised design including different practice types and whole practice teams was a strength of our study. In addition, we were able to draw on good data quality with a high level of completeness for the analyses, waiving the need for imputation. The newly developed IMPROVE*job* leadership program was well accepted, especially the moderated skills training including role-play with trained actors. The multi-professional composition of the research team and the range of contents presented allowed practices to individually select their focus based on their needs; however, the range might have been too broad but not deep enough for some practices. We developed the intervention in a participative approach with repeated input from practices and continuous input from a clinician scientist experienced in practice management. Practices with a very high psychological burden may not have participated in the study. The COVID-19 pandemic, which started between the baseline and follow-up assessments, impaired the study conduct, the implementation processes in practices and the participation in the follow-up data assessment.

Conclusion

The newly developed IMPROVE*job* leadership program with its skills training was well accepted by participants, yet implementation was markedly impaired by the pandemic and the intervention did not improve job satisfaction. Based on the quantitative results, and supported by the qualitative interviews, further innovative approaches to enhance change processes in practices are needed to support the long-term well-being of practice leaders and practice assistants.

Data availability

There are no plans to grant access to the full protocol, participant-level dataset or statistical code as data contain potentially identifying information, but they are available from the corresponding author on reasonable request.

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Author contributions

B.M.W. had the study idea. L.D. drafted the first version of the manuscript together with B.M.W. and J.G. B.M.W., T.S.-D., B.W., E.R., A.S., C.P., V.S., K.-H.J. and M.A.R. contributed to the development of the study design. B.M.W., K.L., T.S.-D., B.W., M.G., E.R., A.S., C.P., A.-L.E. and M.A.R. contributed to the development of the IMPROVEjob intervention. L.D., J.G., A.H. and K.-H.J. performed the data analyses. All authors contributed to the study conduct, provided feedback on the manuscript and approved the final version.

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Competing interests

The authors declare no competing interests.

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IMPROVEjob Research Cooperation

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4 Discussion

4.1 Summary of the key findings

This work is based on data from the IMPROVE*job* trial, which investigated the effects of a multimodal intervention on job satisfaction and chronic stress in 366 GPs and PrAs. The three publications and additional submitted manuscript presented here address the influence of the factors WPC, quantitative work demands and leadership on perceived chronic stress in GPs and general practice teams. In addition to a corresponding model, the constructs and their associated variables were examined.

Lower WPC, less quantitative demands, and higher leadership quality were significantly associated with lower perceived chronic stress whereby WPC had the strongest association (β = 0.31) followed by quantitative demands (β = 0.28) and leadership (β = -0.22). This is particularly interesting because leadership emerged as a highly significant variable even though we controlled the model for the strong variables of WPC and quantitative demands. This protective mechanism of leadership quality was evident for general leadership quality and also for its sub-dimensions transformational leadership (b = -2.68) and ‘innovation of the leader’ (b = -2.23) (Göbel et al., 2023, under review). In addition, we showed high-quality relationships between GP leaders and their employees (Schmidt et al., 2023). An in depth analysis with a 180-degree approach revealed that practice leaders rated themselves higher on most leadership dimensions than they were rated by their staff. Significant differences were found for transformational leadership (d = 0.41), particularly for the dimensions ‘individuality focus’ (d = 0.50) and ‘innovation’ (d = 0.69). For transactional leadership, there was a significant difference on the dimension of ‘goal setting’ (d = 0.30).

Significant differences were also found in the WPC values between practice leaders and PrAs (64.03 vs. 32.67). The significant association between WPC and perceived chronic stress is therefore particularly relevant for practice leaders. This is also confirmed by the fact that the majority of practice leaders work full-time and a full-time job is significantly associated with WPC compared to a part-time job (b = 12.15). In addition, high WPC was significantly associated with lower job satisfaction (b = -0.10; Göbel et al., 2022), a variable that correlates highly with chronic stress in GPs (Degen et al., 2021).

In general, the IMPROVE*job* leadership intervention was very well received, especially by practice leaders. There was no significant effect of the intervention on the main outcome job satisfaction which was likely due to the unforeseen COVID-19 pandemic as identified in additional qualitative data (Degen et al., 2022). The pandemic had a major impact on general practices in Germany, resulting in a reduced capacity to implement leadership content from the IMPROVE*job* intervention (Degen et al., 2022). Based on our findings, the following strategies are relevant to reduce chronic stress in GP teams: 1) reduction of WPC, 2) reduction of quantitative work demands and 3) improved leadership quality. These findings from German primary care are in line with the international literature.

4.2 Supporting the well-being of general practice staff by reducing work-privacy conflict

The importance of WPC as a factor influencing chronic stress and psychological well-being has been demonstrated in international studies: Among others, in a Norwegian longitudinal study aimed at identifying predictors of physician burnout among 638 participants using a statistical approach similar to ours. Multiple regression analysis revealed the predictive value of work-home conflict on burnout with a standardised beta coefficient of $\beta = 0.22$ for male physicians and $\beta = 0.38$ for female physicians (Langballe et al., 2011). This is in line with our analyses, which showed that WPC is a strong predictor of perceived chronic stress with a β-coefficient of 0.31 (Göbel et al., 2023, under review) and is particularly pronounced among practice leaders (Göbel et al., 2022). Our analyses also showed a higher WPC for women than for men in the group of employed physicians (49.43 vs. 31.25; scale: 0–100) (Göbel et al., 2022). The high prevalence of WPC in our sample becomes particularly evident when the practice leaders' scores are compared with those of the German COPSOQ reference population with data on over 250,000 people from various occupational settings. While the mean scale score for the reference population was 39.0 (Lincke et al., 2021), our analyses showed a comparative score of 64.03 (Göbel et al., 2022). This large difference was similar to a US study which compared the WPC scores of 7,288 physicians with a sample of 3442 working US adults: Physicians were significantly less satisfied with their work-life balance (40.2 % vs. 23.2 %) (Shanafelt et al., 2012). The effect of WPC on stress was not only shown in questionnaire surveys, but also by cortisol measurements in body fluids. Bergman et al. (2008) showed that work-

family balance was associated with the stress marker salivary cortisol in both male and female physicians. This highlights the need for targeted interventions to prevent WPC, e.g. workshops and awareness for staff and practice leaders.

4.3 Improving work-related factors for better psychological well-being

Work demands are a well-known source of chronic stress for GPs. This is supported by a Swiss study of 1,755 primary care physicians which used logistic regression to identify work-related stressors as potential sources of impaired psychological well-being (Goehring et al., 2005). In the analysis, excessive perceived stress due to global workload was associated with high levels of burnout (OR = 2.2), making workload one of the strongest predictors in their model (Goehring et al., 2005). These results are consistent with our finding that work demands emerged as the second strongest predictor of perceived chronic stress (β = 0.28) (Göbel et al., 2023, under review). These high quantitative demands were particularly pronounced for practice leaders, which may be explained by the additional management and leadership responsibilities in addition to regular patient care. This is typical of German GPs, who tend to work in owner-managed practices (Freund et al., 2015). In order to reduce chronic stress in GPs and their teams, it is important to reduce job demands or, in line with the well-known Job Demand-Control Model, to increase perceived control over one's own activities (Karasek, 1979). IT-supported delegation models, such as those successfully used in hypertension management, could help with these processes in general practice (Leupold et al., 2023).

4.4 Leadership training as a key element in strengthening mental well-being

In addition to WPC and quantitative work demands, leadership is an important factor in the development of chronic stress and burnout in the workplace (Meredith et al., 2022). Among US medical professionals, a recent systematic review of 15 studies found an association between better leadership and lower levels of burnout (Meredith et al., 2022). In a comprehensive study conducted at the US Mayo Clinic by Shanafelt et al. (2015), leadership ratings explained 11 % of the variance in individual physician burnout in a sample of 2,813 physicians who were asked to rate their immediate physician/scientist leader. A follow-up study at the Mayo Clinic found that a one-point increase in leadership quality was associated with a 9 % reduction in the likelihood of experiencing burnout

among 762 resident physicians (Dyrbye et al., 2020). Our analysis is consistent with these findings: In linear regression models, leadership as an independent variable explained 13% of the variance in perceived chronic stress (Göbel et al., 2023, under review).

Our studies are among the few which aim to quantify the complex relationship between WPC, work demands and leadership on perceived chronic stress (Göbel et al., 2023, under review). We identified leadership as a particularly important variable in explaining physicians' psychological well-being. This is demonstrated by the highly significant coefficients in our model along with other strong predictors (according to previous research). Our models showed a higher variance explanation (adjusted $R^2 = .37$) compared with other models that do not include leadership (e.g. Goehring et al., 2005; variance explanation: 19 %). The inclusion of several factors associated with perceived chronic stress is particularly relevant for general practitioners who —in contrast to hospital physicians— are self-employed and have management responsibilities for their own business and are accountable for their own health and the health of their employees. These findings emphasise the need for strong leadership training in general practice to positively influence the psychological well-being of GPs and their teams, and thereby support the primary care workforce.

4.5 Strengths and limitations

The IMPROVE*job* study was designed as a cluster-randomised controlled trial, using a novel skills training approach to leadership training. Unfortunately, the COVID-19 pandemic necessitated some changes to the study protocol, including a reduction in the total workshop duration. Based on extensive data from 60 German general practices, the associations of important parameters such as WPC, quantitative demands and leadership on perceived chronic were analysed, meeting the requirement that complex multi-parameter scenarios such as general practices require multi-parameter approaches to explain the psychological well-being of GPs and their teams. However, a transfer of the results to other settings requires caution due to a potential selection bias, as participating practices may have had a greater interest in the workshop content and practice leaders with highly impaired psychological well-being may not have participated. In addition, the results are mainly based on cross-sectional data, which do not allow for a causal

interpretation. Nevertheless, our data show a need for tailored leadership interventions in general practice as the IMPROVE*job* intervention was very well accepted, especially by GPs with leadership responsibilities (Degen et al., 2022).

4.6 Conclusion

This work demonstrates the importance of leadership interventions in the context of general practice. In future interventions, particular attention should be paid to the quality of the relationship between practice leaders and their teams, specific leadership styles and dimensions such as transformational leadership. Tailored interventions can help reduce chronic stress among GPs and their teams. It should also be noted that changing leadership behaviours takes time, which should be considered in the study design and follow-up measures. The WPC and work demands perspective should also play a role in future interventions, ideally with interventions for systematic reduction. Thus, in addition to policy measures, leadership training at all levels of medical education and postgraduate training, including for experienced physicians, can be an important element to support the health of GPs and their teams as well as secure a strong primary care workforce.

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