Multimodal leadership intervention to improve job satisfaction of general practice teams

The cluster-randomised IMPROVE*job* study

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List of abbreviations

BMBF	German Ministry for Education and Research (‚*Bundesministerium für Bildung und Forschung*‘)
CI	Confidence Interval
COPSOQ	Copenhagen Psychosocial Questionnaire
cRCT	Cluster-Randomised Controlled Trial
EGPRN	European General Practice Network
FIF	Questionnaire on Integrative Leadership (‘*Fragebogen zur Integrativen Führung’*)
FRLM	Full Range of Leadership Model
GP	General Practitioner
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
UK	United Kingdom

1 Abstract

Introduction: The health of general practice teams is crucial for sustainable healthcare systems. However, general practice teams are highly burdened by chronic stress and burnout. Burdening work factors and leadership are among the most influential predictors of the psychological well-being of general practice teams. Based on this evidence, the IMPROVE*job* study evaluated job satisfaction before (publication 1) and after participation in the IMPROVE*job* intervention for general practice teams (publication 2). A simulation analysis addressed the issue of waiting times in practices (publication 3).

Methods: The IMPROVE*job* intervention consisted of theoretical inputs and practical skills trainings: in two leadership workshops the topics leadership, communication, workflows and work organization were addressed. The primary outcome job satisfaction was measured by the respective scale of the German version of the Copenhagen Psychosocial Questionnaire (German COPSOQ, version 2018). The main secondary outcomes were chronic stress (Trier Inventory for the Assessment of Chronic Stress Screening) and leadership (questionnaire on Integrative Leadership).

Results: Publication 1 showed a high degree of job satisfaction at baseline as well as high levels of chronic stress among general practice teams. As shown in publication 2, no significant effect of the IMPROVE*job* intervention on job satisfaction was detected at follow-up due to the Covid-19 pandemic. However, the intervention was very well accepted by the participants. Furthermore, we showed a high influence of workflows (variation of consultation time) on patient waiting times which is a known major stressor for general practice teams (publication 3).

Discussion: The multimodal IMPROVE*job* intervention was appropriate and well-tailored to the target group, but lacked effect due to the Covid-19 pandemic as an unforeseen major event. In addition, there is a need for further studies to address the complex work situation in general practices as a multi-parameter scenario aiming at improving job satisfaction and reducing chronic stress in general practice samples.

2 Introduction

2.1 Relevance of the health of general practice teams

The health of general practice teams is crucial to provide sustainable health care (Lesage et al., 2013; Søvold et al., 2021) which is associated with a better health of populations (Starfield et al., 2005). Several UK studies demonstrated that regions with a scarcity of general practitioners (GPs) show worse patient health although every citizen is covered by the National Health Service (NHS) (Bankart et al., 2013; Baker et al., 2016). In detail, a comprehensive investigation of all GP practices in England revealed a strong negative association between the number of GPs per 1000 patients and patient mortality rates (-4.31; 95% CI -6.8 to -1.8) (Baker et al., 2016). According to a retrospective observational study from England, a high turnover within the general practice workforce is associated with lower patient satisfaction with the practice (-1.3; 95% CI -1.6 to -1.1), more emergency attendances per 100 patients (1.8; 95% CI 1.5 to 2.1) and fewer patients getting a same day appointment (-10.6; 95% CI -11.4 to -9.0) (Parisi et al., 2023). Despite this evidence, a sustainable primary healthcare system is in jeopardy (Dyrbye et al., 2017; Dewa et al., 2017), as many European countries suffer from a decreasing number of GPs, leading to a shortage in the primary care workforce (Owen et al., 2019; Iacubucci, 2019).

Consequently, the health of physicians in a strong primary care workforce is from utmost important to explore, as for example, Wallace et al. described the well-being of physicians as a key indicator for assessing the quality of care and the overall quality of health care systems. There is a strong association of unhealthy physicians, quality of care and patient safety. In addition, health care systems should regularly assess the physicians' health in order to ensure the quality of care (Wallace et al., 2009). This is supported by findings in a meta-analysis, which showed associations between burnout in health care professionals, including primary care physicians, and poor quality of care (Tawfik et al., 2019). In addition, Chung et al. showed a negative association of physician burnout and patient-reported experience with physician-patient communication (Chung et al., 2020).

2.2 Job satisfaction and psychological burdens of practice teams

Job satisfaction is considered to be a construct that is influenced by several factors simultaneously. In the understanding of job satisfaction, there are different relevant theoretical approaches discussed. One of the most important is Herzberg's Two Factors theory, which suggests that extrinsic factors (e.g. working conditions and leadership) and intrinsic factors (e.g. job recognition) influence subjective perceptions of work. To maintain high levels of job satisfaction, both factors need to be addressed to a sufficient degree (Herzberg et al., 1967). This is crucial, as job satisfaction is positively associated with life satisfaction and overall well-being (Bowling et al., 2011).

Regarding primary care physicians, job satisfaction and other indicators of psychological well-being are widely studied. The outcomes evaluated comprise job satisfaction, burnout, chronic stress, depression, intention to leave the job and leaving the job. Most data available relate to job satisfaction as well as the psychological burdens burnout and chronic stress. High levels of job satisfaction were shown among 523 German (5.58 of 7) and 1,174 Norwegian GPs (52.6 of 70) (Götz et al., 2010; Nylenna et al., 2005). Such high levels of job satisfaction are attributable to several factors. According to Götz et al., high degrees of satisfaction with colleagues (6.0 of 7) and the variation of the work (5.77 of 7) were the highest-rated factors among German GPs (Götz et al., 2010). In the Norwegian sample, the primary care doctors reported the highest satisfaction with opportunities to use their own abilities, the cooperation with colleagues, the variation in work, and the freedom to choose their own method of working (Nylenna et al., 2005). This is in line with a Bulgarian study with 223 GPs showing the highest satisfaction with their work autonomy (Parashkevova et al., 2020). Furthermore, a multi-centre qualitative study conducted among 183 GPs from eight European countries highlighted especially the often positively described doctor-patient relationship, the freedom in daily work, and the ability to learn and teach general practice (Le Floch et al., 2019).

However, chronic stress and burnout are highly prevalent among GPs. Different studies indicate high levels of chronic stress among general practice teams (Götz et al., 2011; Götz et al., 2013; Kersting et al., 2019; Viehmann et al., 2017). Viehmann et al. highlighted that chronic stress was highest among female GPs, followed by practice assistants (Viehmann et al., 2017). Following Maslach et al., burnout is one of the major

consequences of work-related stress (Maslach et al., 2001) and is, therefore, a crucial construct in understanding the psychological well-being of GPs. A meta-analysis, including 4,497 French GPs, indicates a prevalence rate of 49% (Kansoun et al., 2019). A comprehensive European study conducted by the European General Practice Research Network (EGPRN) revealed that 12% of a sample of 1,393 GPs experienced significant levels of burnout across all evaluated burnout dimensions (Soler et al., 2008). This finding is consistent with an Irish study of 683 general practitioners of whom 50% experienced symptoms of burnout (O'Dea et al., 2017).

Interestingly, these findings from primary care are in contrast to studies from other occupational groups (e.g., university employees, nurses) which indicate negative correlations between job satisfaction and perceived chronic stress (Ahsan et al., 2009; Nakasis and Ouzouni, 2008).

2.3 Work-related factors influencing psychological well-being

It is essential to understand the work context of general practice teams when addressing psychological well-being. In Germany, general practice teams comprise general practitioners (GPs) (in German "*Fachärztg*innen für Allgemeinmedizin*" and "*Fachärzt*innen für Innere Medizin mit Schwerpunkt hausärztliche Versorgung*") and practice assistants (PrA). Most of the physicians are self-employed but an increasing number is employed in group practices of two to five GPs mainly with GP owners (Aschwanden, 2010). The working environment in general practices is increasingly complex and is burdened with major challenges such as the shortage of skilled practice assistants or increasing patient demands (Döpfmer et al., 2021). Good working environments and processes are essential to keep the workforce healthy. Following Herzberg's Two Factors Theory, working conditions, including various work-related factors, are crucial extrinsic factors to influence job satisfaction and, consequently, psychological well-being (Herzberg et al., 1967). In the medical literature, work-related factors are among the most studied reasons for psychological burdens among GP practice teams. Ongoing burdening work is deeply linked to chronic stress, burnout, increased risk for depression and the wish for early retirement (Rabatin et al., 2016). In addition, work-related factors such as recognition, income, bureaucracy and workload are associated

with lower job satisfaction among European GPs (Le Floch et al., 2016; Marchand and Peckham, 2017). Furthermore, administrative challenges and medical documentation are associated with higher chronic stress among 109 German GPs (Kersting et al., 2019). In addition, work-related factors promote other stressors such as higher patient waiting times and dissatisfaction among patients and personnel (Mehra, 2016).

2.4 Leadership as a factor influencing psychological well-being

Achieving improvements in working conditions requires strong leaders. This follows Herzberg's Two Factors theory stating leadership as a key extrinsic factor to influence job satisfaction and, consequently, psychological well-being (Herzberg et al. 1967). Unfortunately, no standard for leadership training in medical education and following in primary care residency has yet been established (Sadowski et al., 2018; Fennell, 2021), even though leadership becomes an ever more relevant issue in medicine and is widely studied in various theoretical models.

One of these is the Full Range of Leadership Model (FRLM), which is built on the dimensions transactional and transformational leadership. Transactional leadership contains management by exception, the exchange of contingent rewards (e.g., salary for work) and work structuring (Bass, 1999; Poethke 2019; Rowold and Schlotz, 2009). Transformational leadership, in contrast, aims at employees' attitudes and values towards larger goals such as team involvement, change culture, organizational success, and self-actualization (Bass, 1999; Poethke, 2019). Both dimensions are important for successful leadership (Erschens et al., 2022). Hospital employees who perceive their leaders as transformational experience less stress (Baysak and Yener, 2015). Also, transformational leadership is positively correlated with job satisfaction (Boamah et al., 2018) and overall psychological well-being of employees (Arnold, 2017). In a sample of more than 200.000 working professionals from a range of professions, including hospitals, leadership was the most important predictor of job satisfaction (Lincke et al., 2021). Furthermore, higher leadership quality is associated with lower leader and employee stress levels (Harms et al., 2017).

2.5 Objectives

This thesis draws on three publications of the IMPROVE*job* project which was developed and conducted at the Institute of General Practice and Family Medicine of the University Clinic Bonn between 2019 and 2022. The main objective of the IMPROVE*job* study was to evaluate the effectiveness of the IMPROVE*job* intervention on job satisfaction among general practice teams. The three publications included in this dissertation had the following three aims:

1) Presentation of the baseline data of the IMPROVE*job* study population;

2) Evaluation of the effectiveness of the IMPROVE*job* intervention;

3) Investigation of relationships between appointment scheduling and waiting times in practices.

While the publications 1 and 2 are based on real-world practice data collected and analysed during the IMPROVE*job* study, the third publication is based on simulations using literature data on waiting times. These simulations were used to illustrate information to the workshop participants.

2.6 Methods

2.6.1 Study Design

The IMPROVE*job* study was conducted as a cluster-randomised, controlled trial (cRCT) with German general practices as the clusters. The clusters were randomised in an intervention and a control group with the main goal to assess the effectiveness of the IMPROVE*job* intervention. The control group was designed as a waiting list control group with these clusters receiving the intervention after follow-up data collection. For details, see Figure 1. All details on the IMPROVE*job* methodology are published (Weltermann et al., 2020).

The study was approved by the Ethics Committee of the Medical Faculty of the University of Bonn (Reference number: 057/19, date of approval: 20/02/2019). The study was funded by the German Ministry for Education and Research (BMBF).

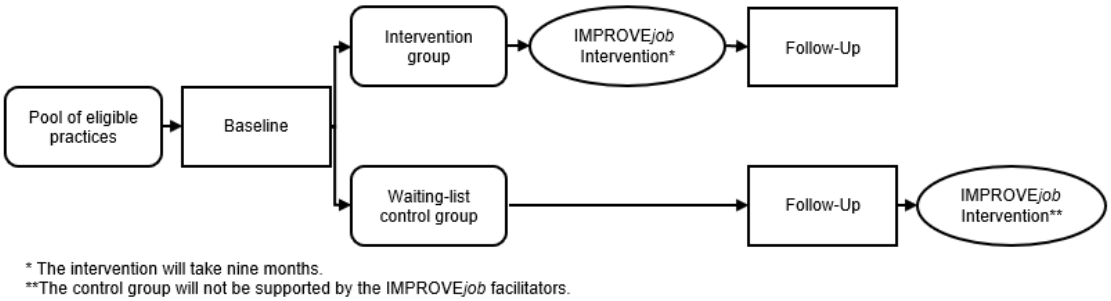

Figure 1: Study design (Degen et al., 2021)

2.6.2 Population and recruitment

Based on the sample size calculation, 56 general practices with an average of four participants per practice were targeted. Practices were recruited from the Bonn/North Rhine region. A total of 60 practices signed written consent and took part in the baseline data assessment. After baseline data assessment, the practices were randomised into the study arms taking the stratification criteria (single/group practices and teaching/non-teaching practices) into account.

2.6.3 IMPROVE*job* Intervention

The final, multimodal IMPROVE*job* intervention consisted of the following elements:

1. Leadership workshop 1 (for leaders only; duration: 4 hours) addressed the topics ‘role of the leader’, ‘leadership styles’ and ‘occupational health and safety’ using theoretical inputs and skills trainings.
2. Leadership workshop 2 (for leaders and their teams; duration: 4 hours) addressed ‘work organization’, ‘communication’, and ‘workplace-based health promotion’.
3. The IMPROVE*job* toolbox contained additional material including the ‘management logbook’ and printed supplemental material.
4. The nine-month implementation phase was supported by trained members of the research team with certified practice assistants, the so-called IMPROVE*job* facilitators. They offered support for the change processes by reminding of the project idea and supporting the practices to achieve their individually selected change goal.

More details of the multimodal IMPROVE*job* intervention are shown in figure 2.

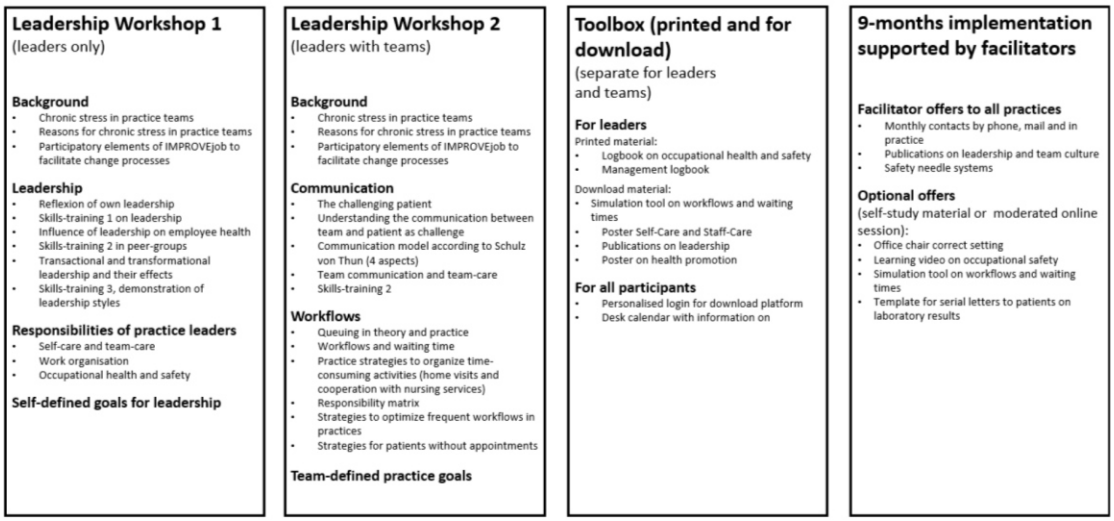

Figure 2: The core elements of the final IMPROVE*job* intervention (Degen et al., 2021)

2.6.4 Questionnaires and outcome measures

The data collection was performed in the practices using paper-pencil questionnaires. The outcomes were selected based on theoretical considerations and prior studies in the target group.

a) **Job satisfaction:** The change in job satisfaction from baseline to follow-up data assessment was the primary outcome of the IMPROVE*job* study. Job satisfaction was assessed by using the German version of the Copenhagen Psychosocial Questionnaire (German COPSOQ, version 2018). The job satisfaction scale is built of five items and is completed with a global item (‘How pleased are you with your job as a whole, everything taken into consideration?’), assessed with a 5-point Likert scale. Following the recommendations from the COPSOQ manual, the answers were transformed to a score from 0 (minimum value, ‘not satisfied at all’) to 100 (maximum value, ‘fully satisfied’) (Burr et al., 2019).

b) **Chronic stress** was assessed using the German short version of the Screening Scale of the Trier Inventory for the Assessment of Chronic Stress (TICS-SSCS). The TICS-SSCS comprised 12 items rated on a 5-point Likert scale. The individual item scores were

combined into a sum score ranging from 0 to 48 with 0 indicating `never stressed´ and 48 representing `stressed very often´ (Petrowski et al., 2012; Schulz et al., 2004).

c) **Leadership** was measured using the questionnaire on Integrative Leadership (FIF, '*Fragebogen zur Integrativen Führung'*). In total, we assessed data on the six dimensions of transformational leadership (team spirit, innovation, performance development, individuality focus, being a role model, providing a vision) and the two dimensions of transactional leadership (goal setting, management by exception). All items were assessed on a 5-point Likert scale (Rowold and Poethke, 2017).

d) **Sense of community** was measured by the respective scale of the German version of the Copenhagen Psychosocial Questionnaire (German COPSOQ, version 2018). The scale consists of two items and the answers were transformed to a score ranging from 0 (minimum value, 'lowest sense of community') to 100 points (maximum value, 'highest sense of community') (Burr et al., 2019).

2.6.5 Statistical Analysis

Descriptive statistics of the sample and the questionnaire items were performed at baseline. We conducted multilevel regression models to compare the change in job satisfaction from baseline to follow-up between the two study arms. In addition, we analysed for associations between the change in job satisfaction (between baseline and follow-up) and sociodemographic data (gender, age, occupational group and working full-time) as well as the secondary outcomes leadership and sense of community at follow-up. All analysis respected the clustered data structure. SPSS Statistics 27 (IBM Corporation, 2020), SAS 9.4 and RStudio were used for statistical analyses. The significance level was defined at $p < 0.05$.

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3 Publications

Publication 1: Job Satisfaction and Chronic Stress of General Practitioners and Their Teams: Baseline Data of a Cluster-Randomised Trial (IMPROVE*job*), *International Journal of Environmental Research and Public Health, 2021.*

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Article

Job Satisfaction and Chronic Stress of General Practitioners and Their Teams: Baseline Data of a Cluster-Randomised Trial (IMPROVE*job*)

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Abstract: *Background*: A high prevalence of poor job satisfaction and high chronic stress is documented for general practitioners (GPs) and non-physician practice staff from various countries. The reasons are multifactorial and include deficits in leadership, communication and workflows. This publicly funded study evaluates the effectiveness of the newly developed participatory, interdisciplinary, and multimodal IMPROVE*job* intervention on improving job satisfaction among GPs and practice personnel. Here, we report the baseline characteristics of the participating GPs and practice assistants, focusing on job satisfaction and perceived chronic stress. *Methods*: The IMPROVE*job* study was performed as a cluster-randomised, controlled trial (cRCT) with German GP practices in the North Rhine Region. The IMPROVE*job* intervention comprised two leadership workshops (one for practice leaders only; a second for leaders and practice assistants), a toolbox with supplemental printed and online material, and a nine-month implementation phase supported by IMPROVE*job* facilitators. The intervention addressed issues of leadership, communication, and work processes. During study nurse visits, participants completed questionnaires at baseline and after nine months follow up. The primary outcome was the change in job satisfaction as measured by the respective scale of the validated German version of the Copenhagen Psychosocial Questionnaire (German COPSOQ, version 2018). Perceived chronic stress was measured using the Trier Inventory of Chronic Stress (TICS- SSCS). *Results*: Recruitment of 60 practices was successful: 21 were solo, 39 were group practices. At baseline, n = 84 practice owners, n = 28 employed physicians and n = 254 practice assistants were included. The mean age of all participants was 44.4 (SD = 12.8). At baseline, the job satisfaction score in the total sample was 74.19 of 100 (±14.45) and the perceived chronic stress score was 19.04 of 48 (±8.78). Practice assistants had a significantly lower job satisfaction than practice owners ($p < 0.05$) and employed physicians ($p < 0.05$). In the regression analysis, perceived chronic stress was negatively associated with job satisfaction (b= −0.606, SE b = 0.082, $p < 0.001$, ICC = 0.10). *Discussion*: The degree of job satisfaction was similar to those in other medical professionals published in studies, while perceived chronic stress was markedly higher compared to the general German

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population. These findings confirm the need for interventions to improve psychological wellbeing in GP practice personnel.

Keywords: job satisfaction; perceived psychological stress; primary care; general practices; participatory intervention; psychological wellbeing; leadership; structural prevention; behavioural prevention

1. Introduction

Research in several European general practitioner (GP) populations has shown that job satisfaction is linked to work-related factors [1–3]. Among the factors known to reduce job satisfaction are excessive work hours, high workload, time pressure, bureaucracy, insufficient salary and lack of appreciation [3]. Ongoing burdening working conditions have been associated with chronic stress, burnout, depression and early retirement. In addition, there is a correlation with poorer patient outcomes [4–11]. Compared to the general population, a study by Viehmann et al. showed that physicians and non-physician staff in German general practices are twice as often affected by self-reported high chronic stress [12].

Multiple reasons for high levels of chronic stress in GPs have been shown, such as insufficient leadership skills, poor work organisation and lack of communication with patients and within the team [13,14]. There are various approaches to reduce chronic stress in a GP setting. For example, a study from Australia showed a reduction of stress levels in a GP sample using a cognitive behavioral coaching program [15]. Fortney et al. showed that a mindfulness intervention reduced stress in primary care physicians [16]. A variety of approaches have been developed and evaluated which aim at improving the mental health of healthcare workers [17]. The majority of the interventions target individual behaviour such as stress management through, e.g., meditation or training of self-care [18,19]. However, based on the European Principles of Occupational Health and Safety, interventions should first target the work environment and focus on individual behavioural prevention thereafter [20]. A review of organisation-related interventions showed that health-promoting effects are enhanced if the interventions simultaneously focus on working conditions, work processes and work equipment [21,22]. Based on such evidence, we designed the IMPROVE*job* intervention to improve job satisfaction among German general practice personnel focusing on the aspects of leadership, communication, and work processes with an organisational change approach.

The IMPROVE*job* intervention comprised two workshops, one for GPs with leadership responsibilities and one for GPs and other practice personnel, educational material as well as an implementation phase of nine months supported by IMPROVE*job* facilitators. The study was initiated by an academic general practitioner. The intervention itself was developed using a participatory approach: experts from the fields of general practice and family medicine cooperated with those from operations research, occupational and psychosomatic medicine, health promotion and epidemiology to develop a target-group-oriented multimodal intervention; general practitioners and practice assistants were regularly asked to provide input and feedback in order to tailor the intervention to the needs of general practices. The intervention addressed central potential determinants of job satisfaction and chronic stress in GP practices, namely leadership, communication, work organisation and workflows, workplace health promotion and occupational health and safety [22]. The IMPROVE***job*** intervention is of relevance as the problem of chronic stress in the primary care workforce has not been solved.

The effectiveness of the intervention on job satisfaction is studied in a cluster-randomised trial with personnel from German practices. Details on the study protocol have been published [22]. Here, we report the baseline characteristics of the participating practices, GPs and practice assistants, focusing on job satisfaction and perceived chronic stress.

2. Materials and Methods

2.1. Study Design

The IMPROVE*job* study was performed as a cluster-randomised, controlled trial (cRCT) with personnel from GP practices who were randomised in an intervention and a control group (Registration number: DRKS00012677). The control group was conducted as a waiting list control group, i.e., these participants received the intervention after the collection of follow-up data. The study aims at evaluating the effectiveness of the IMPROVE*job* intervention on increasing job satisfaction as measured by the German version of the COPSOQ 2018 (primary outcome). Study nurses visited practices for the collection of baseline data prior to randomisation. The intervention lasted nine months. For details, see Figure 1.

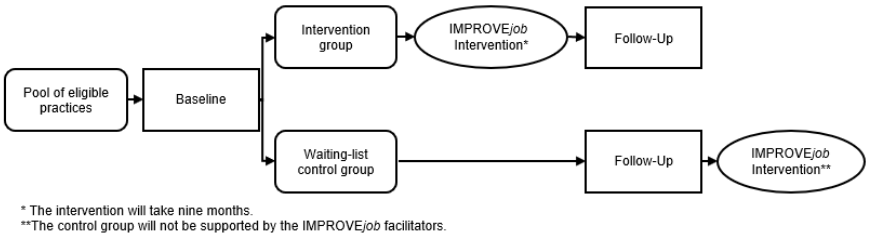

Figure 1. Study design [22].

2.2. Target Population: Practices and Practice Personnel

The study population consists of practice personnel of general practices of the North Rhine Region in Germany. The details are outlined in our study protocol [20]. As background information on the German healthcare system, GPs typically are the first point of contact for patients in primary care and provide an interface with the rest of the healthcare system, yet initial contacts to secondary care is also possible for patients. GP practices are small businesses most frequently owned by primary care physicians, who may employ other physicians and practice assistants [23].

The following inclusion and exclusion criteria were applied. Practices were included (1) If their owner was registered as general practitioner of the Association of Statutory Health Insurance Physicians of North Rhine with or without affiliation as teaching practice of the University of Bonn or the University of Cologne. (2) If the practice owner and at least one practice assistant provided informed consent for study participation. We aimed at recruiting all members of a participating practice team including physicians and practice assistants in training. Practices were excluded if special situations such as a relocation of the practice or retirement of the owner were imminent. Additionally, practices that had participated in the development of the IMPROVE*job* intervention or participated in the feasibility study of the intervention were excluded.

According to the sample size calculation (for details, see [22]), a total of 56 practices with an average of 4 participants per practice were targeted for recruitment, allowing 2 dropouts each in the intervention and control group. The randomisation took place after baseline data collection and was performed by an independent researcher of the Centre for Clinical Studies Essen. It was stratified for (a) single/group practice and (b) teaching/non-teaching practice.

2.3. Recruitment and Non-Responder Analysis

Practice recruitment was carried out by the Institute of General Practice and Family Medicine of the University of Bonn. Invitations were sent by letter, fax or e-mail including participant information and the practice consent form to be signed by the practice owner. An incentive of EUR 50 was offered per participant completing the follow-up data collection. If practices did not answer after more than three contacts, reasons for non-responding were gathered by fax. The recruitment process started in September 2019. A total of

1141 practices were contacted—387 teaching and 754 non-teaching practices (for details, see Figure 2)—assuming a higher participation rate among teaching practices. During phone recruitment, practices frequently voiced interest in the topic but felt unable to participate in three workshops within six weeks as originally planned (for details, see [22]). The practice assistants in particular considered two team workshops as too time consuming. Of the 1141 practices contacted, a total of 60 practices agreed to participate. Detailed written non-responder information was available for 288 practices and showed that 'no interest' (57%), 'no time' (23%) and 'no need' (9%) were the most common reasons for non-participation. Based on the oral feedback during recruitment and the results derived from non-responder analysis, the IMPROVE*job* consortium decided to reduce the intervention from three to two workshop afternoons. This restructuring of the workshops was carried out without loss of content, as some material was newly provided online.

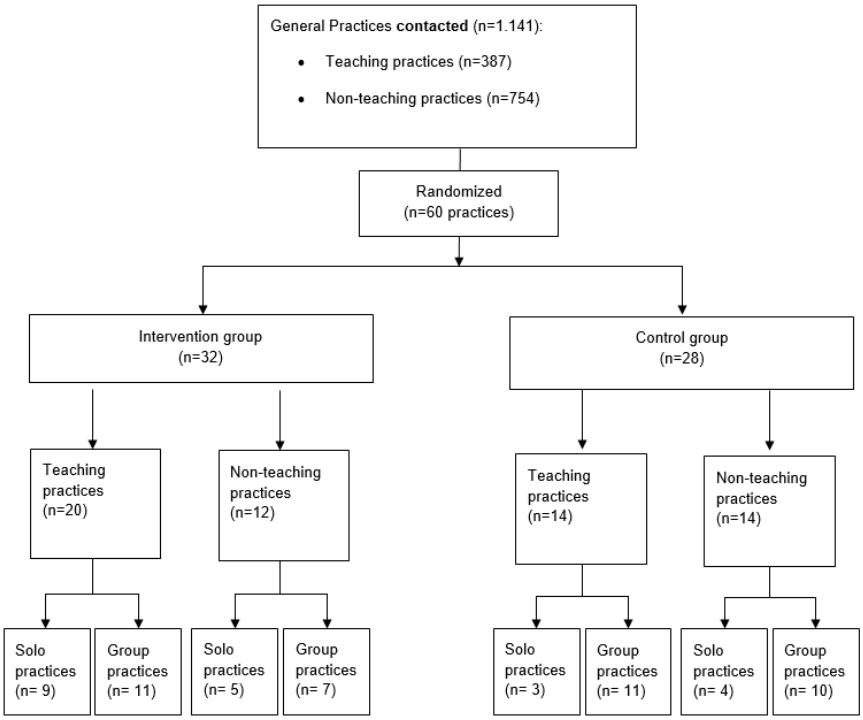

Figure 2. Recruitment flow chart.

*2.4. IMPROVE*job *Intervention*

The final multi-modal IMPROVE*job* intervention consisted of the following elements (Figure 3):

1. Two leadership workshops: one workshop for practice leaders only, and a second workshop for the leaders together with their practice teams;
2. The toolbox with supplemental material: printed and online material including learning videos;
3. The implementation phase of nine months supported by IMPROVE*job* facilitators.

The intervention workshops comprised four hours each on Wednesday afternoons, which were held two weeks apart. For each workshop set, an average of 4 to 6 practice teams was invited. This allowed for about 6 to 10 physicians and 15 to 25 practice assistants per workshop series. A total of 6 workshop sets were carried out between November 2019 and March 2020. The workshops contained presentations by the research team combined with interactive elements, self-reflection, peer exchange, and skills-trainings supported by simulation practice assistants/patients. The latter were recruited from the simulation patient pool of the University Hospital Bonn, and were trained by the researchers. Workshop 1 for physicians with leadership responsibilities (practice owners

and employed physicians with leadership responsibilities) addressed the topics 'role of the executive', 'leadership styles' and 'occupation health and safety for GP practices' in theory and practice.

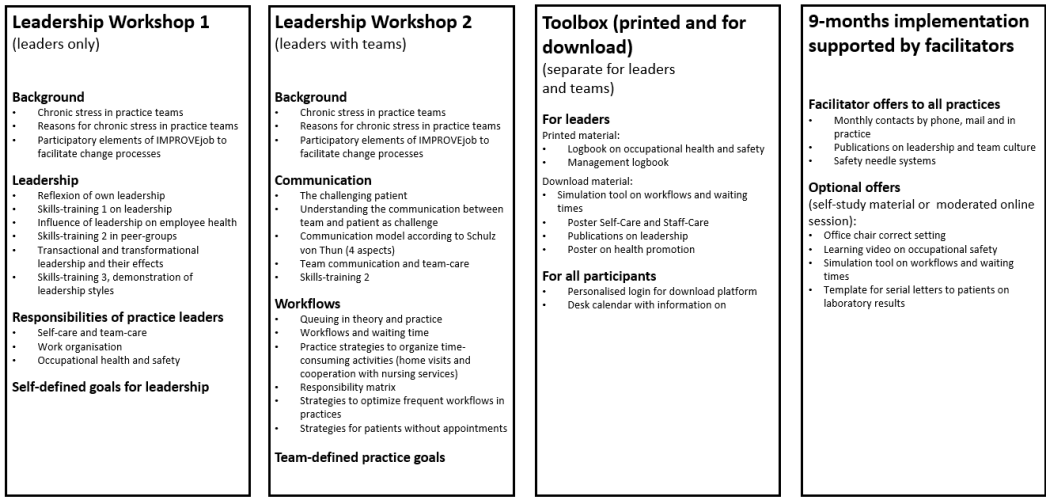

Figure 3. Elements of the IMPROVE*job* intervention.

Workshop 2 for physicians with leadership responsibilities and all practice employees focused on the topics 'work organisation including appointment scheduling', 'workplace health promotion', 'communication', and 'occupational health and safety'.

At the end of workshop 2, each practice decided on self-selected improvement goals. In addition, the toolbox was introduced and an outlook on the upcoming implementation phase supported by IMPROVE*job* facilitators was given.

The toolbox contained content presented in the workshop and additional material: The 'management logbook' for physicians with leadership responsibilities, the 'employee logbook', the desk calendar for practice teams with multiple contents from the workshops and supplemental material for download.

After workshop 2, the nine-month implementation phase supported by IMPROVE*job* facilitators began. The facilitators were trained members of the research team with professional experience as practice assistants who supported practices in their change processes by giving information via phone/mail and offering up to 5 practice visits with additional material. The main goal of the facilitators was to keep the IMPROVE*job* idea alive for 9 months and to help each practice to achieve their self-defined practice goals.

Due to the COVID-19 pandemic, with a lockdown in Germany starting in mid-March 2020 and the need to abstain from gatherings in larger groups, the last team workshop of the intervention group and all workshops for the control group were performed as online meetings. Therefore, the content was modified for application as interactive online video-sessions; some elements were integrated into an e-learning-platform. Overall, the intervention content remained identical.

2.5. Baseline Data Collection and Outcomes

The baseline data collection was performed by trained study nurses from the Center for Clinical Trials, University Hospital Essen, during a prescheduled appointment in the participating practices to assure that all practice personnel were present. Questionnaires differed slightly by professional role (for practice leaders, employed physicians, and practice assistants). In addition, the physician practice owners filled in a questionnaire addressing practice characteristics, such as practice type, number of employees and patients. For details, see [22].

2.5.1. Primary Outcome

The primary outcome of the IMPROVE*job* study was defined as change in job satisfaction, measured by the respective scale of the German version of the Copenhagen Psychosocial Questionnaire based on the international COPSOQ version (German COPSOQ, version 2018). The job satisfaction scale consists of 5 items and is combined with an additional global item ('How pleased are you with your job as a whole, everything taken into consideration?') using a 5-point Likert scale. To calculate scores, we followed the recommendation for the COPSOQ transformation: the answering scales were transformed into a score ranging from 0 (minimum value, 'not satisfied at all') to 100 points (maximum value, 'fully satisfied') [24].

The outcome 'job satisfaction' was chosen as the primary outcome because the IMPROVE*job* study evaluates a complex intervention that takes into account various factors known to influence the psychological wellbeing.

2.5.2. Secondary Outcomes

Using questionnaires, the following additional aspects were requested from the participants: (1) leadership, (2) general health and work ability, (3) work-related experience and behaviour patterns, (4) perceived chronic stress, (5) occupational safety culture, (6) stress coping strategies applied by participants, (7) work organisational issues including waiting times, team roles and team activities, and (8) team activities and roles. The details are published in our study protocol [20]. This baseline paper describes the following baseline results:

1. Baseline characteristics of the study participants.
2. Job satisfaction as the primary outcome measured with the respective COPSOQ scale.
3. Perceived chronic stress: To measure chronic stress, the German short version of the Screening Scale of the Trier Inventory for the Assessment of Chronic Stress (TICS-SSCS) was used. The TICS-SCSS consists of 12 items using a 5-point Likert scale (range 0–4). All 12 items are added up to a sum (0–48), where 0 is the lowest possible and 48 the highest possible perceived stress in the last 3 months [25].

2.6. Statistical Analysis and Ethics' Statement

A description of the sample was carried out at the individual participant level and at the cluster level (GP practices) in total and stratified by study arms.

Baseline data on the primary outcome (job satisfaction) and perceived chronic stress will be analysed in the whole sample. Subgroup descriptions will be performed in relevant strata, such as (a) practice owner, employed physician and practice assistant and (b) teaching compared to non-teaching practices. All variables will be described using standard descriptive methods appropriate to their measurement level. Parametric measures such as mean and standard deviation are reported to allow for comparability of the results. Subpopulations were compared using T-test statistics. A p-value below 0.05 was considered significant.

Following our study protocol [22], the COPSOQ score for job satisfaction (German COPSOQ version 2018) and the TICS-SSCS sum were calculated according to the standards for these scales. In addition, we calculated the respective COPSOQ items of the COPSOQ version 2021, which includes an extra item addressing satisfaction with income. This item was under evaluation when we conducted the study and is now included. A mixed linear regression model was used to calculate the association of perceived chronic stress with job satisfaction, respecting practice clusters. Statistical analyses were conducted with SPSS for Windows, version 25 (IBM Corp., Armonk, NY, USA).

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).

3. Results

Study Populations: Baseline Characteristics of Practices and Practice Personnel

Of all n = 60 practices randomised, n = 21 were solo practices (n = 14 intervention group vs. n = 7 control group) and n = 39 were group practices (n = 18 intervention vs. n = 21 control group). n = 34 teaching (20 in intervention and 14 in control group) and n = 26 non-teaching practices (12 in intervention and 14 in control group) were included.

A total of 366 practice personnel took part at baseline: 84 physician practice owners, 28 employed physicians and 254 practice assistants (Table 1). At the practice level, the percentage of personnel participating ranged from 20.0 to 100% (mean = 73.4%). T-tests showed no statistically significant difference between baseline data of perceived chronical stress (TICS-SSCS), t(359) = 0.778, p = 0.437 between the intervention (n = 182) and control group (n = 179). Additionally, there was no statistically significant difference regarding job satisfaction (German COPSOQ, version 2018) between the intervention (n = 180) and control group (n = 181), t(361) = −0.463, p = 0.644.

Table 1. Sociodemographic description of participants at baseline.

Sociodemographic Description	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)

At baseline, the mean age of all participants was 44.4 years (±12.8). Practice owners were, on average, ten years older and more likely to work full-time compared to the other two professional groups. The practice owners worked for 15.3 (±8.4) years in the current practice, the employed physicians for 3.9 (±5.4) and the practice assistants for 8.8 (±8.9) years.

As indicated by large standard deviations, practice assistants varied markedly regarding age, training and living situation. On average, n = 235 had graduated 19.9 (±13.3) years ago, while n = 19 were still in training. Of the practice assistants, 38 were qualified for advanced tasks (so called VERAH/EVA qualification). On average, the practice assistants worked 32.7 (±10.7) hours per week in the last 3 months.

At baseline, the mean job satisfaction score (German COPSOQ, version 2018) in the total sample was 74.19 of 100 (±14.45, Median: 75); using the 7-item scale (COPSOQ 2021), the mean job satisfaction score was 72.58 of 100 (±14.66, Median: 75).

The perceived chronic stress score was 19.0 of 48 (±8.78, Median: 19). Two practice owners were identified as outliers for the job satisfaction score. As they did not signifi-

cantly skew results, they are included in the following analyses. Practice assistants had a significantly lower job satisfaction than practice owners ($p < 0.01$) and employed physicians ($p < 0.05$). No statistically significant difference was observed between the occupational groups for perceived chronic stress. For details, see Table A1.

Figures 4 and 5 show a graphical overview of the main outcome job satisfaction measured with the COPSOQ B11 (German COPSOQ, version 2018) and perceived chronic stress measured with the TICS-SSCS scale stratified by occupational groups and study arms.

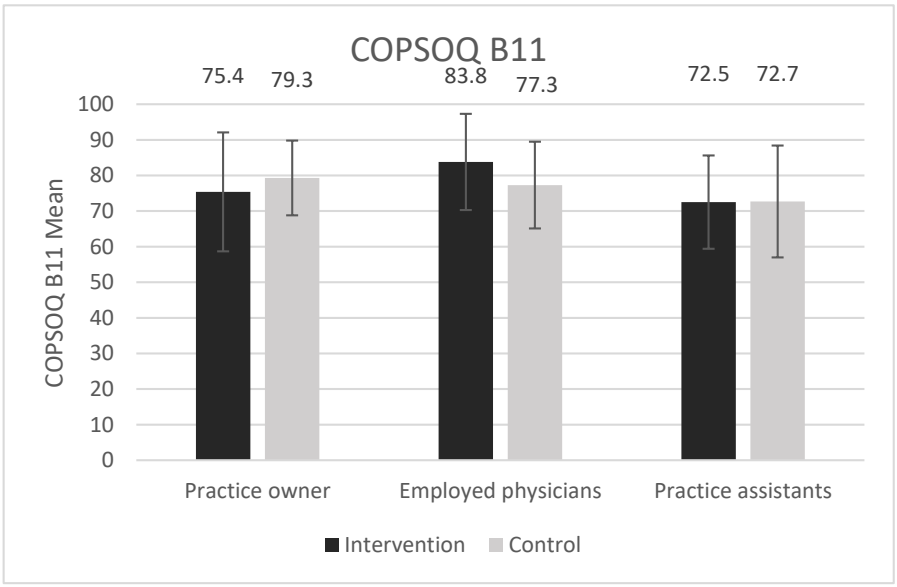

Figure 4. Job satisfaction (German COPSOQ, version 2018): mean scores of practice owners, employed physicians and practice assistants for intervention and control group. Error bars show standard deviations. There are no significant differences between groups at baseline ($p > 0.05$).

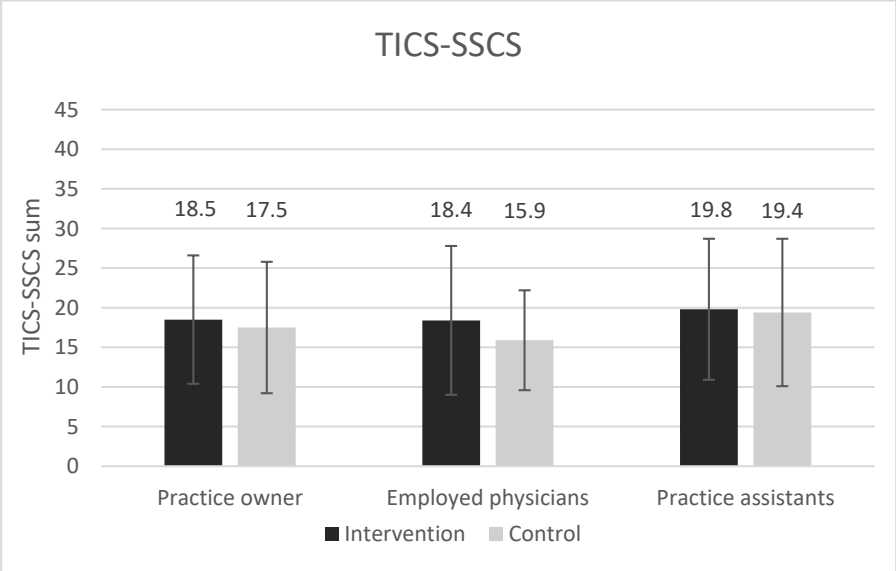

Figure 5. TICS-SSCS sum scores of practice owners, employed physicians and practice assistants are shown for study arms. Error bars show standard deviations. All presented differences between intervention and control group are non-significant ($p > 0.05$).

Overall, the mixed regression model showed a significant negative association between perceived chronic stress and job satisfaction (German COPSOQ, version 2018) respecting the practice clusters (b = −0.606, SE b = 0.082, $p < 0.001$, ICC = 0.10). There

was also no relevant difference when using the COPSOQ 2021 (b = −0.632, SE b = 0.083, $p < 0.001$, ICC = 0.10).

4. Discussion

In line with prior studies [12–14], we showed a high job satisfaction among GP practice personnel, yet, at the same time, a high level of perceived chronic stress. To our knowledge, this is the first study in this target group that measured both job satisfaction and perceived chronic stress simultaneously. As expected, the results show an inverse relationship between job satisfaction and perceived chronic stress. Comparing physicians and practice assistants, the latter showed higher perceived chronic stress and a significantly lower job satisfaction. Yet, compared to 2017 data of the COPSOQ databank across all occupations, all GP practice personnel showed markedly higher job satisfaction (74.19 vs. 62.3 of 100) [26]. Focusing on the medical field only, practice owners and employed physicians in our study scored higher regarding job satisfaction than more than 2000 hospital physicians documented in the COPSOQ databank (77.16 and 79.61 compared to 62.4). Likewise, practice assistants in our study scored higher than >8000 hospital-based nurses from the COPSOQ databank (72.58 vs. 57.8) [26]. Similar to our results, Goetz et al. demonstrated a high job satisfaction in 523 GPs and 1158 practice assistants using the 10-item Warr–Cook–Wall questionnaire [13,27] rather than the COPSOQ scale, which does not allow for direct comparison. A survey from Denmark showed low job satisfaction for 22.1% of the participating GPs with a limited comparability to our population [28].

A number of studies in GP practice personnel addressed the complex relationship of working conditions and the psychological wellbeing of practice staff. Based on four studies, a literature review indicated that task delegation in general practice is viewed positively by practice staff and contributes to job satisfaction, mainly due to the autonomy perceived [29]. Goetz et al. showed that practice assistants were most satisfied with their team colleagues, but dissatisfied with their income [27]. Practice assistants were more likely to report a higher job satisfaction if a good working atmosphere was present, indicated by, e.g., opportunities to contribute to practice improvement and having defined responsibilities within the practice team. Likewise, Hoffmann et al. identified various factors influencing mental workload, which is defined as the exposure to individual work demands in 550 practice assistants from 130 practices: social support at work and participation were identified as the key protective factors [30]. Our multimodal IMPROVE*job* intervention including workshops and a nine-month implementation phase addressed several of these aspects aiming at reducing the psychological stress and strain for physicians and practice assistants in primary care. Hereby, the burden of perceived chronic stress deserves special attention, as our baseline results show a mean of 19 among all participants as measured by the TICS-SSCS. Stratified by occupational groups, there was a difference between employed physicians (16.79), practice owners (18.06) and practice assistants who had the highest level (19.62). These results are in line with the findings of Viehmann et al. in 2017, which showed high levels of perceived chronic stress, especially among practice assistants within $n = 136$ German GP practices [12]. The perceived chronic stress of GP practice personnel is obvious through a comparison with representative data from the German general population reported in the "German Health Interview and Examination Survey for Adults" (DEGS1): while the DEGS1 showed a median TICS-SSCS score of 11 [31], our target group had a median score of 19 using the same study instrument. Although job satisfaction is relatively high, the high scores for perceived chronic stress demonstrate the potential relevance of the IMPROVE*job* intervention.

5. Strengths and Limitations

After the described reduction in the number of intervention workshops, the target number of practices ($n = 60$) was recruited successfully. Yet, we cannot exclude that practices with very high perceived chronic stress did not participate in the study. The stratified randomisation, with respect to teaching and non-teaching practices as well as solo

and group practices, is an important methodological feature influencing the generalisability of the results. Additionally, the baseline characteristics of the practices and participants as well as the scores for job satisfaction and perceived chronic stress did not differ between intervention and control group, which will facilitate the assessment of intervention effects. Subgroup analysis regarding the association of job satisfaction and chronic stress was likely limited due to the small sample of employed physicians. Our sample size was rather large (>360 participants), yet any generalization needs to be handled with caution.

6. Conclusions

Compared to data from large German representative samples, GPs and practice assistants in our study showed above average scores for job satisfaction and perceived chronic stress at baseline. Comparison of these baseline results with our follow-up data will show whether these indicators of mental wellbeing in the primary care workforce can be successfully improved by our IMPROVE*job* intervention. In line with other studies, we showed an urgent need to improve mental well-being of the primary care workforce. Any successful approach to reduce chronic stress will have practical implications given the relationship between chronic stress and job satisfaction. Further research to address the complex workplace scenarios in primary care practices is needed.

Author Contributions: Conceptualization, B.M.W., M.A.R., T.S.-D.,C.P. and B.W.; methodology, B.M.W. M.A.R., L.D., T.S.-D., B.W., M.G., E.R., A.-L.E., C.P., V.S., S.K., M.S., and J.G.; validation, V.S.; formal analysis, M.S. and J.G.; investigation, L.D., K.L., T.S.-D., B.W., E.R., C.P., A.-L.E., S.K., J.G., M.A.R. and B.M.W.; resources, B.M.W., L.D., K.L., T.S.-D., B.W., M.G., C.P., E.R. and A.-L.E.; data curation, V.S.; writing—original draft preparation, L.D. and B.M.W.; writing—review and editing, L.D., T.S.-D., B.W., M.G., E.R., A.-L.E., C.P., V.S., S.K., M.S., J.G., M.A.R. and B.M.W.; visualization, J.G.; supervision, B.M.W., M.A.R. and B.W.; project administration, K.L., E.R., B.M.W. and M.A.R.; funding acquisition, B.M.W., M.A.R., C.P. and B.W. All authors have read and agreed to the published version of the manuscript.

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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 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 Nordrhein (Lfd-Nr.: 2019107), and of the Medical Faculty, University Hospital of Tuebingen (Project-No.: 446/2019BO2) approved the study protocol.

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 dataset or statistical code as data contain potentially identifying information.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Job satisfaction (German COPSOQ, version 2018) and perceived chronic stress: total sample and stratified by profession as well as study arm.

Job Satisfaction and Perceived Chronic Stress, Stratified	Total Sample								Intervention Group						Control Group					
	N	Total	N	Practice Owner	N	Employed Physician	N	Practice Assistant	N	Practice Owner	N	Employed Physician	N	Practice Assistant	N	Practice Owner	N	Employed Physician	N	Practice Assistant
Job Satisfaction, mean (SD)	363	74.19 (14.45)	84	77.16 (14.30)	28	79.61 (12.85)	251	72.58 (14.42)	46	75.37 (16.69)	10	83.75 (13.53)	126	72.49 (13.14)	38	79.33 (10.55)	18	77.31 (12.23)	125	72.68 (15.65)
TICS, mean (SD)	361	19.04 (8.78)	83	18.06 (8.15)	28	16.79 (7.45)	250	19.62 (9.07)	46	18.54 (8.10)	10	18.40 (9.35)	126	19.79 (8.92)	37	17.46 (8.29)	18	15.89 (6.28)	124	19.44 (9.26)

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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.

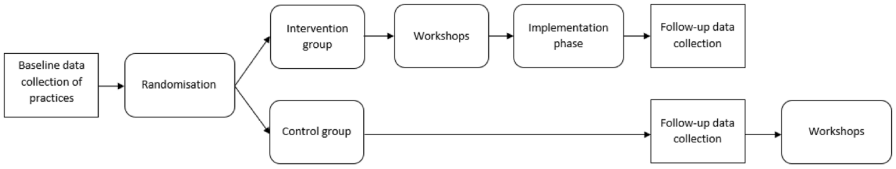

Figure 1. Study design[18].

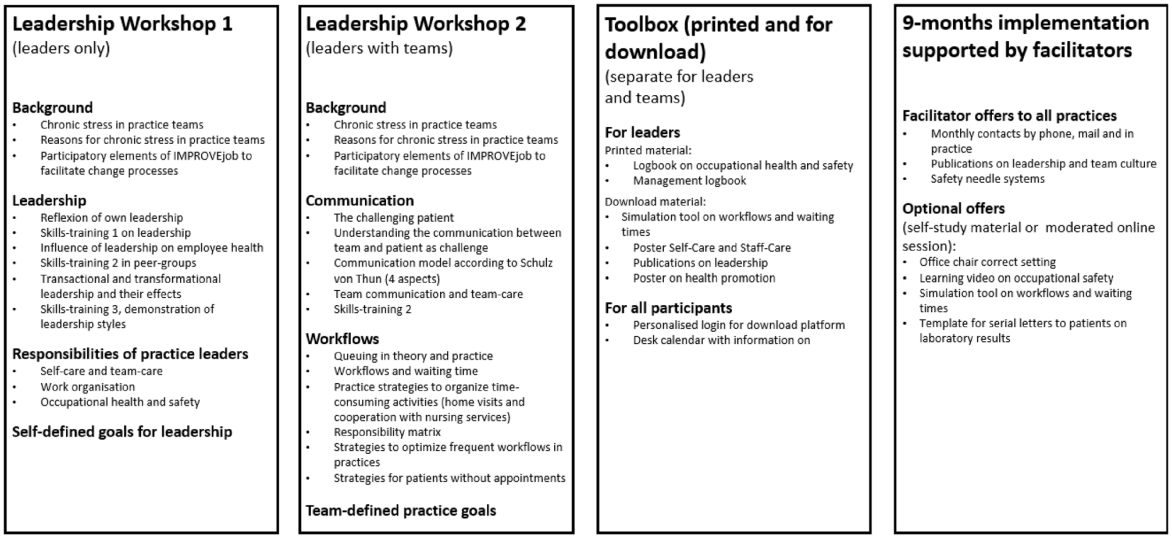

Figure 2. Elements of the IMPROVE*job* intervention[(25, p. 5)].

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.

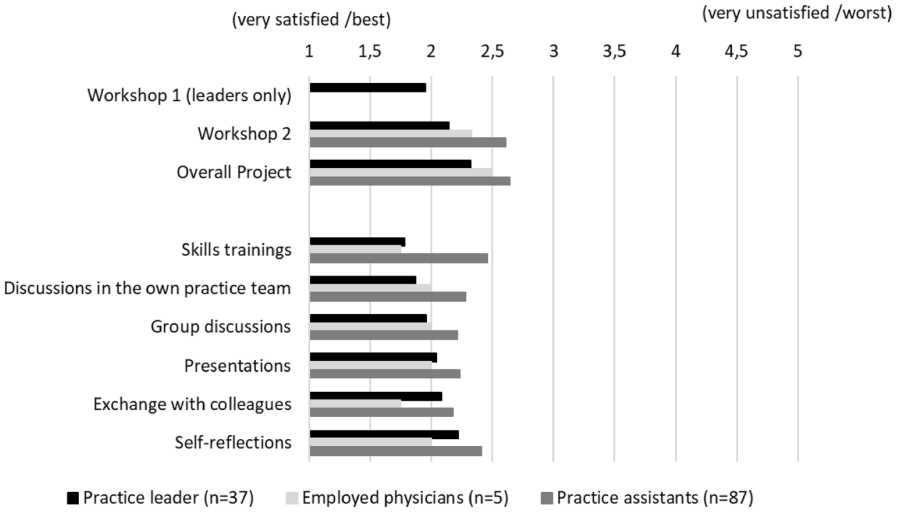

Figure 3. Evaluation of the intervention elements.

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.

Additional information

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IMPROVEjob Research Cooperation

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Publication 3: Small Changes in Patient Arrival and Consultation Times Have Large Effects on Patients' Waiting Times: Simulation Analyses for Primary Care, *International Journal of Environmental Research and Public Health, 2023.*

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MDPI

Article

Small Changes in Patient Arrival and Consultation Times Have Large Effects on Patients' Waiting Times: Simulation Analyses for Primary Care

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Abstract: (1) Background: Workflows are a daily challenge in general practices. The desired smooth work processes and patient flows are not easy to achieve. This study uses an operational research approach to illustrate the general effects of patient arrival and consultation times on waiting times. (2) Methods: Stochastic simulations were used to model complex daily workflows of general practice. Following classical queuing models, patient arrivals, queuing discipline, and physician consultation times are three key factors influencing work processes. (3) Results: In the first scenario, with patients arriving every 7.6 min and random consultation times, the individual patients' maximum waiting time increased to more than 200 min. The second scenario with random patient arrivals and random consultation times increased the average waiting time by up to 30 min compared to patients arriving on schedule. A busy morning session based on the second scenario was investigated to compare two alternative intervention strategies to reduce subsequent waiting times. Both could reduce waiting times by a multiple for each minute of reduced consultation time. (4) Conclusions: Aiming to improve family physicians' awareness of strategies for improving workflows, this simulation study illustrates the effects of strategies that address consultation times and patient arrivals.

Keywords: general practice; appointment scheduling; consultation strategies; waiting times; stochastic discrete event simulation

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1. Introduction

Workflows remain a daily challenge in general practices. Poor workflows promote direct waiting times, productivity losses, dissatisfaction, and no-show rates on behalf of patients, as well as chronic stress among practice personnel [1–5]. While indirect waiting times represent the willingness to wait for a prescheduled appointment [6,7], direct waiting times represent a patient's time in the practice waiting for the consultation [7]. According to German data from 2008 to 2020, about 90% of patients experience some direct waiting time before consulting their physician. Waiting times range from no waiting time to longer than 120 min, with outliers of more than 2 h in up to 2% of patients [8]. High waiting times are associated with less patient satisfaction [4,5] and medical compliance, as well as increased no-show rates [3]. Hence, the investigation of direct waiting times is crucial for improving medical care. In recent years, simulation models and other studies from operations research have offered profound theoretical insights into how to optimize workflows with relevant practical implications [9–12].

The theoretical foundation of research on waiting times and workflows is based on the queuing theory [10,11], which refers to the mathematical study of an operating system with waiting lines. The main purpose is to gain information on queue lengths, the waiting

times of clients requiring some kind of service, and the utilization of the service system. A theoretical general practice can be considered as a queuing system with three main components (see Figure 1): 1. the arrival process (frequency and types of patients arriving), 2. the service mechanism (here: physician capacities, including consultation time and idle time before serving the next patient), and 3. the queuing discipline (treatment order, e.g., with/without unscheduled emergency patients).

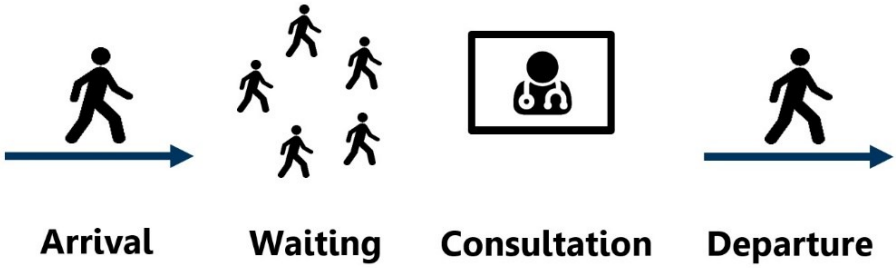


Figure 1. A queuing system in a general practice has three key components: arrival process, services (physician consultation and idle time), and queuing discipline (treatment order, e.g., as scheduled with/without emergency patients).

The mathematical results from operations research, which are well published, have provided the following fundamental principles [12,13]: A fully utilized server (doctor) will lead to infinite waiting times in the long run, even if there is only a small degree of variation in arrival or consultation time. Under an equidistant schedule (e.g., every 10 min), waiting times per patient will always increase the later a patient is scheduled (even in optimized schedules) if there is only little variation [14]. Additional sources of variation that play a key role in scheduling are no-shows and walk-ins without appointments [15]. To minimize waiting times, the idle time of the physician needs to increase [16]. The latter principle is especially important in primary care with its patient-centered care philosophy [17]; frequently, a single patient's needs are hardly predictable when scheduling [18].

In operations research, various models were developed in order to find the appointment schedule that performed best in terms of patient waiting times, physician idle times, or other performance metrics in clinical environments [15,19]. Regarding the first aspect of a practice´s queuing system, the patient arrival process (see Figure 1), the main challenges for practices are the allocation of appointments, the distribution of patient requests to weekdays, the number of walk-ins without appointments, appropriate time slots, and suitable buffers [20–23]. The second aspect of the model, the physician capacity can be influenced by increasing the number of physicians or increasing the capacity of each physician. Theoretically, the latter can be achieved with shortened consultation times, reduced set-up times, and more equal consultation lengths using, e.g., standardized information and consultation procedures, yet patients´ complex care demands limits to the implementation of these options. Furthermore, the influence of patient scheduling and physician time on the quality of care needs to be considered. A positive example from the literature addressed systematic diabetic care scheduling: A decrease in consultation time with an increase in patients seen per day allowed the physician to see more patients before disease deterioration, which yielded better diabetes control for all patients affected by a higher glucose level [24].

This paper aims to support the interdisciplinary transfer of knowledge from the appointment scheduling and queuing literature to family medicine. Using data from the literature and appropriate assumptions, we present two scenarios to illustrate the general effects of patient arrival and consultation times on waiting times. To reflect a frequent scenario in general practices, a single busy morning is analyzed while using two additional actions that demonstrate the benefits of responding quickly to strongly increasing waiting times.

2. Materials and Methods

2.1. Simulation Model

To evaluate the impact of patients' arrival rates and physician consultation times on waiting times, we implemented a simulation model by using the commercial software Anylogic® (The AnyLogic Company, Chicago, IL, USA). If the next patient always arrives as soon as the treatment of the previous one is completed, there are no waiting times. This is completely different when patient arrivals and treatment durations fluctuate. It is well known from queuing theory that for an almost fully utilized server with varying arrivals, the queue length tends to infinity. The simulation model illustrates a simple treatment process to address the overall impact of variation in consultation time (scenario 1) and patient arrivals (scenario 2). These are realistic scenarios because care processes may vary in content and include additional workflows, e.g., blood collection, ECG, or lung function testing, which differ by patient and practice. The patient flow in a practice is modeled as a single-server queuing system to demonstrate the general effects on direct waiting times. The patient flow is as follows: Initially, the patient arrives at the practice. If the physician is idle, the patient directly enters the service. A patient who finds the physician busy joins the end of a single waiting queue. When the physician completes a service, the next patient is chosen from the waiting queue on a first-come-first-served (FCFS) basis. No priorities are considered. After consultation, the patient immediately leaves the practice. All patients generated for a particular day have to be treated on the same day. If the work capacity limit of the physician is reached, extra hours are conducted.

2.2. System Parameters and General Assumptions

The input parameters of our simulation model are based on the literature and the experiences of primary care researchers and general practitioners. On each day, patients are treated for eight hours, which are separated into a five-hour morning and three-hour afternoon session, interrupted by a two-hour break. When consultation times exceed the five-hour morning session, the physician sees patients during the break and works overtime. The simulation covers a period of one year consisting of 260 independently simulated working days, which do not differ in patient arrival or physician consultation patterns. Therefore, the results of the simulation are the average of 260 runs, each with about 63 patients. The physician consultation times follow the commonly used log-normal distribution [25,26] to represent typical variations in the duration of treatment.

2.3. Scenarios Addressing the Arrival Process (Scenarios 1 and 2)

For patient arrivals, two cases are considered. First, we analyze the effects when patient arrivals are fixed, accounting for situations when patients meet their appointments on time. Second, simulating walk-ins without appointments, patients are generated following the commonly used Poisson process with exponentially distributed inter-arrival times [27,28]. The average consultation and average patient inter-arrival times are set to 7.6 min based on the empirical service time of general practitioners in Germany, which is the shortest consultation time compared to five other European countries, with an overall mean of 10.7 min [29]. Regarding the consultation times, the medium variation is set equal to the standard deviation (SD) value from the literature of 4.3 min [29]. Low, high, and very high variations equal 0.5, 1.5, and 2 times the SD value, respectively. Thus, we can systematically analyze the impacts of varying consultation times on patient waiting times alone and in combination with varying inter-arrival times of patients.

2.3.1. Scenario 1—Fixed Patient Arrivals

Patients' inter-arrival times are fixed to a constant value in order to separate the effects of variation in consultation times and patient inter-arrival times. It is assumed that patients arrive for their appointments on time every 7.6 min. The first patient arrives and is in the consultation immediately. The consultation takes 7.6 min with variations of 2.15, 4.3, 6.45 or 8.6 min (standard deviation (SD)). Independently of the ongoing consultation's

duration, the second patient arrives after 7.6 min and needs to wait in case a random value corresponding to the SD is added. After the first patient has left, the second patient directly enters the consultation, which also takes 7.6 min plus or minus one of the random values with the defined SD. The third patient arrives 7.6 min after the second patient's arrival time and needs to wait if any additional variation occurred before. This process is repeated for all following patients.

2.3.2. Scenario 2—Random Patient Arrivals

Both patient arrivals and physician consultation times are varied in order to show the combined effects. This corresponds to a situation with only walk-ins. Patients still arrive every 7.6 min on average, but may also arrive later or earlier. This scenario follows the same process as that of scenario 1 and includes a variation in patient arrival times such that patients arrive every 7.6 min with variations (standard deviation (SD)).

2.4. Detailed Half-Day Analyses Based on Scenario 2

To provide further insights, especially on the maximum waiting times, we aimed to analyze the effect of a considerable individual delay in consultation times on the patients' waiting times. Such extensive consultation times can occur due to unforeseen urgent patient demands due to medical emergencies [30]. To illustrate how a significant delay in patients' consultations affects the individual patients' waiting times if there is no reaction, we consider a busy 5 h morning session. We follow the assumptions of scenario 2 with walk-ins and stochastic consultation times. A total of 49 patients arrive during the 5 h session, and the physician consultation time is assumed to be 7.6 min on average, with a standard deviation of 4.3 min.

To analyze the total savings in patients' waiting times, we exemplify two possible consultation strategies for reacting to unforeseen long consultation times with subsequently long waiting times. Strategy 1 shortens the consultations of all subsequent patients to a fixed 6 min slot. This may be possible if, for example, buffers are implemented in the appointment schedule or the physician can focus on the central patient concerns while rescheduling an appointment on a different day for additional but not urgent demands. Strategy 2 illustrates considerably shorter consultation times for the following five patients to compensate for the delay and resumes the stochastic 7.6 min consultation time afterward.

3. Results

In the following, we present the simulation results to quantify the effects of varying physician consultation and patient arrival times on patient waiting times. Based on the results of both scenarios, 'take-home messages' are outlined.

3.1. Scenario 1: Fixed Patient Arrivals

In the first scenario, patients' inter-arrival times are fixed to a constant value to separate the effects of variations in consultation times and patient inter-arrival times. It is assumed that all patients with an appointment follow the schedule. As described, the patient inter-arrival times were set to 7.6 min, which is equal to the average physician consultation time in Germany. Thus, it is assumed that patients arrive at their appointments on time every 7.6 min.

Since the average physician's consultation time equals the patient's inter-arrival times, no waiting times occur when there are no variations in consultation times. As detailed in Figure 2, greater variations in consultation time, as indicated by the standard deviations in parentheses, lead to longer waiting times for individual patients' average (blue diamond) and maximum waiting times, although the mean consultation duration remains unchanged at 7.6 min. Further, while average waiting times moderately increase for greater variations in treatment times, the waiting times of individual patients can dramatically increase—up to more than 200 min in this case.

Take-Home Message 1. Less variation in consultation times during a day, e.g., by categorizing appointment types and lengths, reduces waiting times. For example, patients

with known higher needs can be booked in two (or more) standard slots rather than one slot.

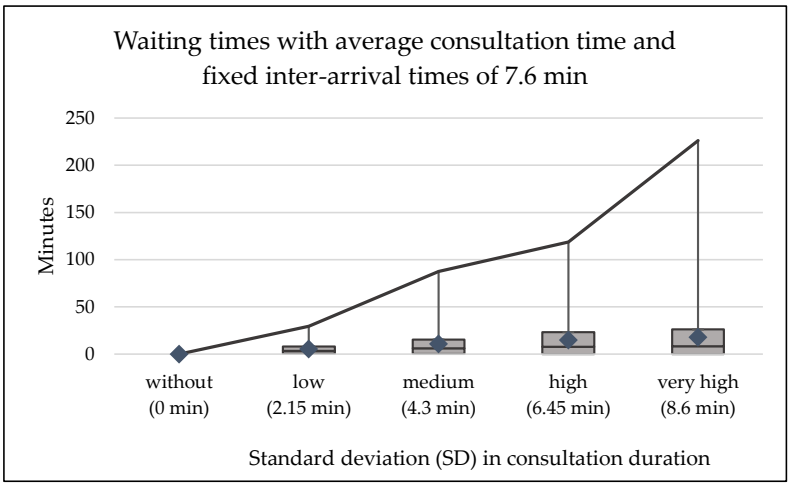


Figure 2. Average, 25%, 75%, and maximum patient waiting times for various standard deviations (in parentheses) in consultation times if only patients with appointments arrive on time every 7.6 min.

3.2. Scenario 2: Random Patients' Arrival

In the second scenario, both patient arrival and physician consultation times are varied to show the combined effects. This corresponds to a situation with only walk-ins. Patients now arrive, on average, every 7.6 min, but may also arrive later or earlier, and the same assumptions as those detailed above are applied. Figure 3 shows the combined effect of walk-ins and variations in consultation times on the average patient waiting times compared to the average waiting time in scenario 1. If patients' arrivals are not scheduled, an average waiting time of about 20 min per patient results, even when there is no variation in consultation times. Higher standard deviations in consultation times lead to even longer average waiting times.

Take-Home Message 2. Influencing patient arrival behavior, e.g., by scheduling appointments in combination with the respective information of patients, reduces patients' waiting times.

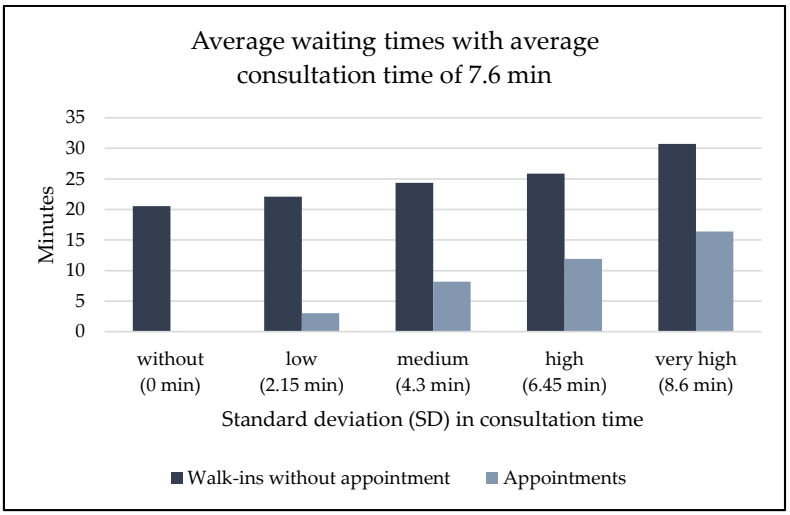
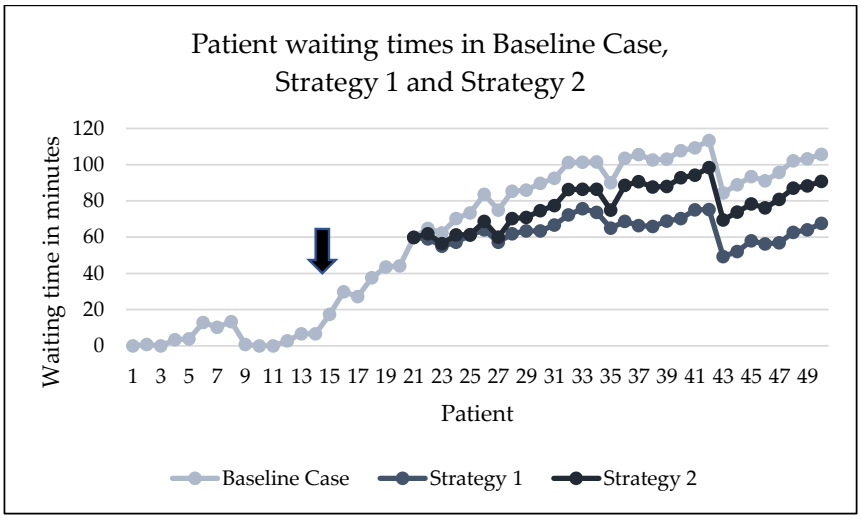


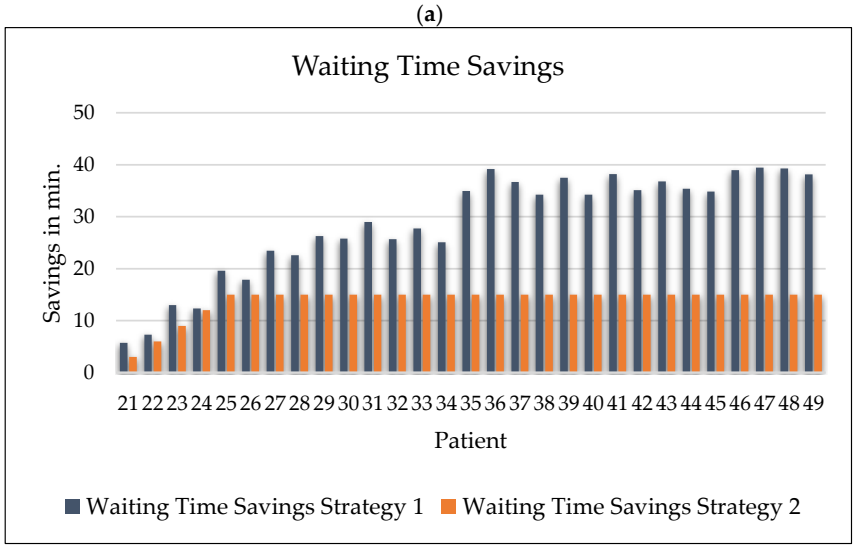
Figure 3. Comparison of patient waiting times in scenario 1 ('fixed appointments') and scenario 2 ('walk-ins') for different standard deviations in consultation time.

3.3. Detailed Half-Day Consideration: Effects of Consultation Time Strategies on Patients' Waiting Times

Following the assumptions of scenario 2, the half-day consideration examines 5 h of a working day with stochastic (random) patient arrival and stochastic consultation times. For illustrative purposes, we selected a scenario where a major delay occurred. On this specific day, the effects of two intervention strategies are demonstrated. Such delays may also occur in practice when emergencies have to be interposed. It is straightforward that the earlier these extreme exceedances occur, the greater the impact on the waiting times for the entire day will be if no adjustments are made. Thus, it is essential to compensate them with either constant or reduced consultation times (or both) for as many patients as possible. Figure 4a,b illustrate these options.



(**a**)



(**b**)

Figure 4. (**a**) Scenario 2 with an unforeseen long consultation time of an additional 15 min for patients 14 and 15 (see arrow). The light blue line shows the increase in waiting time if the treatment duration remains unchanged (Baseline). The mid-blue line shows the reduction in waiting times for Strategy 1 (reduction in consultation time to constantly 6 min), and the dark blue line shows the reduction in waiting times for Strategy 2 (reduction in consultation time by 3 min for the following five patients). (**b**) Waiting time savings for all subsequent patients when following Strategy 1 or Strategy 2 compared to the baseline case.

3.3.1. Baseline Case

In the baseline case, consultation durations remain unchanged, while a delay occurs for patients 14 and 15. The gray–blue line in Figure 4a indicates an increasing waiting time for patients throughout the subsequent morning. Especially after patient 21, waiting times of more than 60 min occur. In total, this represents the baseline case with a total physician consultation time of about 380 min and a total waiting time of the patients of about 2790 min.

3.3.2. Strategy 1: Fixed, Slightly Reduced Consultation Times without Any Variance

In reaction to the delay in our example, the consultation times are reduced from an average of 7.6 min to a constant 6 min. Hence, any variance in consultation is eliminated, and the physician's total consultation time is reduced by around 40 min. The dark blue line represents this extreme strategy in Figure 4a. As a result, some patients are treated longer and others are treated for a considerably shorter time. The variations in waiting times result from the variations in patients' inter-arrival times. The reduced waiting times per patient are shown in Figure 4b. In total, 834 min of patient waiting times can be saved compared to the baseline case by following this intervention strategy.

3.3.3. Strategy 2: Considerably Shorter Consultation Times for a Few Subsequent Patients

An alternative strategy is to considerably shorten the consultation time for the five subsequent patients to compensate for the unforeseen long consultation time of an additional 15 min. In this example, the physician reduces the following five consultation times by 3 min each. This reduces the total consultation times for these patients by 15 min. All other consultation times remain the same. Thus, the delay does not influence the subsequent patient appointments. Thereby, the physician reduces the patients' waiting times by 405 min in total (Strategy 2) compared to the baseline case, with no change in consultation durations. The bars in Figure 4b show the total waiting time savings for individual patients compared to the baseline case if the physician follows Strategy 1 or Strategy 2. Due to the cumulative effect of waiting time savings, the total waiting time of patients can be markedly reduced by a fast reaction of the physician. Strategy 1 results in higher waiting time savings for each individual patient compared to Strategy 2 and, thus, results in higher total savings. However, the efficiency of Strategy 2 can be considered higher compared to Strategy 1 in terms of the necessary reduction in consultation times. We calculated the average waiting time savings per minute of reduced consultation time to determine the efficiency. For this purpose, the ratio of total waiting time savings divided by the reduction of total consultation times is determined. This ratio equals 21 for Strategy 1 and 27 for Strategy 2. In other words, Strategy 1 and Strategy 2 result in a reduction in average waiting times of 21 and 27 min, respectively, for each minute of reduced consultation time.

Take-Home Message 3. The sooner a delay in consultation time is detected and the sooner the physician is able to intervene with shorter and less variable consultation times for as many patients as possible, the greater the potential reduction of waiting times for all subsequent patients will be. In practice, this can be achieved, e.g., by focusing on the most clinically important patient need(s) with rescheduling of the patients for a different day to address other needs.

4. Discussion

Drawing on established operations research principles and methods, our simulation analyses aim at increasing physicians' and other practice personnel´s awareness of the key factors that drive patients' waiting times, namely, patient inflow and consultation length. Although most assumptions are based on real-life data, the results are not ready-to-use-instructions, but they exemplify important principles that allow for the development of long- and short-term implementation strategies for individual practice settings.

In the framework of intraday scheduling, we focused on the variability of direct waiting times with three take-home messages for general practices. The first message (fewer

variations in consultation times lead to shorter waiting times) emphasizes that measuring, categorizing, and determining consultation times is needed to derive practice-specific standard (fixed) appointment lengths as the basis for improved operational workflows, e.g., consecutively scheduling predictable appointments as check-ups or follow-ups. For implementation, the variety of appointment types has to be reduced, consultation types have to be categorized, contingency plans for unpredicted events have to be developed, and scarce resources have to be increased [30]. However, single patients' needs are hardly predictable when scheduling, since a variety of patients and health issues is a characteristic of family medicine [31]. It is a known challenge that patients often do not indicate all consultation reasons to the receptionist. This also implies that patients with known higher needs may require a double or triple slot of the practice's standard consultation time, which can be considered when scheduling. From our own experience and discussions with general practitioners (GPs) and practice assistants, this approach is realistic because the personnel typically knows which patients require more physician time.

The second take-home message (appointment scheduling reduces patients' waiting times) points at the need for scheduling systems rather than walk-ins, although some patient populations, e.g., younger patients [32] and those with difficulties in contacting practices in advance, prefer same-day appointments. In the COVID-19 pandemic, the issue of appointment scheduling has become essential to prevent disease transmission within practices, e.g., with separate office hours for suspected or diagnosed COVID-19 cases [33]. The so-called "advanced access scheduling", which is one of the most investigated models, consists of a combination: It keeps a defined number of same-day appointment slots unscheduled to preserve them for acute care and unforeseen events [34], while foreseeable patients, e.g., for chronic care, are still prescheduled [35]. A recent literature review identified the five pillars for the advanced access model. One was described as the processes of appointment booking and scheduling [36]. Reducing waiting times and no-show rates can increase the patient volume and the productivity of the provider [37]. However, it does not provide a benefit if the patient demand for appointments is constantly higher than the physicians' capacity [38]. This advanced scheduling model is quite similar to the carve-out model, which reserves fixed time slots for physicians to take care of urgent demands [30]. These fixed time slots are unoccupied and act as a buffer to offset urgent demands and/or delays. According to the so-called stochastic carve-out model, a few open slots at the beginning of the session and during the day, e.g., every hour, can reduce waiting times [38]. The ORCA (Optimal Reservation of Capacity for Appointments) optimization model provides strategies for inter-day appointment scheduling, i.e., booking of foreseeable appointments on days that typically have less demand. It aims at determining physicians' optimal appointment capacities to reduce waiting times while balancing the providers´ workload over the week and preventing overtime [20]. Important research has pointed at the relationship between physician idle time and patients´ waiting time; to minimize waiting times, the physician idle time needs to increase [16]. For implementation in real life, this can be done by adding some idle time to an average appointment length, which—if not needed to reduce waiting times—can be used by physicians for other tasks, e.g., office work.

The third take-home message (the need for early interventions to counteract consultation delays) shows the effects of strategies for acute interventions. Patients with predictable requests, e.g., check-up or follow-up consultations, can be postponed, and tasks that can be delegated to non-physician personnel can save time during the actual consultation [34]. Various delegation models, e.g., for wound care, hypertension management, and other health topics, are evaluated or even routinely implemented in various countries [39,40] to increase physicians' capacities. In addition, alternative care strategies in primary care settings were applied in different studies:

A study among pediatric patients showed that medical assistant service applications on smartphones improved the follow-up attendance [41]. Online pre-registration was shown to reduce waiting times in walk-in patients in an outpatient medical depart-

ment [42]. In addition, shared medical appointments and group office visit approaches are innovative approaches for increasing the capacity of general practices and reducing waiting times [43,44].

Furthermore, phone, email, and video consultations are effective ways to reduce waiting times [34]. Their use increased during the COVID-19 pandemic [45,46], and they found a broad acceptance among German medical professionals [47]. They were especially helpful for preventing the transmission of COVID-19 while keeping up high medical care [47].

Simulation approaches allow for investigations of alternative scenarios without cost-intensively modifying real systems [23]. To implement insights into general practices, a number of steps are needed, which start from an understanding of the real-life setting and the communication processes and decisions of physicians and their teams. Furthermore, the implementation of a scheduling system requires ongoing communication with patients, e.g., to reduce walk-ins and achieve the punctuality needed to successfully realize a selected approach.

Strengths and Limitations

The simulation model, with its focus on two variables—patient arrival and physician capacity—reduces the complexity of scheduling in real life to better illustrate key parameters, but this implies a simplification. The average consultation time of 7.6 min [29] does not cover any additional tasks of the physician, such as documentation and other patient-related inquiries. However, a comparison of publicly available data on waiting times [8] with the results of the simulations showed a plausible agreement. Comparable simulation studies can be performed to investigate a deviating patient volume with adjusted treatment durations, e.g., during flu seasons. The model used does not reflect other scheduling options, such as buffer slots and inter-day appointments, varying patient flows depending on the weekday [20], no-shows and walk-ins, or differing practice structures, e.g., group practices. We did not consider alternative strategies, e.g., delegation models or smartphone applications for appointment scheduling. In addition, some of the strategies evaluated may not necessarily be feasible for each practice setting.

5. Conclusions

This paper illustrates the large effects of small changes on waiting times and aims to increase the awareness of this topic based on typical scenarios. The results are not generally applicable solutions, but illustrate potential applications of these principles to practices' workflows. Prospectively, extending the simulation model beyond the two key variables—consultation times and patient inter-arrival times—will lead to more complex but also more accurate representations of real-world practices. Given the physician shortages in many countries, there is a need to intensify empirical research on workflows in primary care and on how to implement findings from theoretical frameworks to better support general practitioners and their teams as the largest ambulatory health care profession.

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4 Discussion

4.1 Key results

The three publications from the IMPROVE*job* study addressed important aspects of the challenging work situation and its consequences on general practice teams' well-being in German general practices. The key findings were: 1) At baseline, high levels of chronic stress and high levels of job satisfaction were shown among the participating 84 practice leaders, 28 employed physicians and 254 practice assistants (Degen et al., 2021). 2) The IMPROVE*job* intervention had no significant effect on the main outcome job satisfaction. According to additional qualitative data, this result was influenced by the unexpected Covid-19 pandemic which challenged all practices heavily and reduced capacities to implement IMPROVE*job* strategies. However, the IMPROVE*job* leadership intervention was rated very well by all participants, especially by the practice leaders (Degen et al., 2022). 3) The simulation analysis highlighted the importance of low variance in consultation times to achieve good workflows with little waiting times (Grot et al., 2023).

4.2 Leadership and leaders' self-care as factors supporting psychological well-being

Overall, the IMPROVE*job* results confirmed prior studies showing high work demands, leadership and sense of community play a role in this complex working environment. Although the IMPROVE*job* intervention had no significant effect on the primary outcome job satisfaction, the mainly leadership-centred intervention was very well accepted by general practice leaders and their teams. This marks the multimodal intervention as appropriate and well-tailored to the target group. This is crucial as high levels of leadership quality are strongly associated with lower leader and employee stress levels (Harms et al., 2017). Also, high transformational leadership is linked to higher employee job satisfaction (Boamah et al., 2018) and lower levels of employee stress (Baysak and Yener, 2015). These results imply that leadership trainings should be included in graduate medical education.

In addition to creating a chronic stress-preventive work environment, GP practice leaders have the important task of taking care of themselves in order to stay healthy and maintain

their own workforce sustainable (Lesage et al., 2013; Søvold et al., 2021). A review by Posluns & Gall highlighted the importance of a proactive approach of self-care among healthcare practitioners to stay healthy and capable of working (Posluns and Gall, 2020). This is supported by a study from Richards et al. showing the mediating effect of self-awareness between self-care and well-being of 148 health professionals while self-care correlated positively with well-being (Richards et al., 2010). Sanchez-Reilly et al. gave an important overview of tools and strategies for physicians to care for themselves including wellness-centred interventions, self-awareness and mindfulness strategies in addition to healthy lifestyle advices (Sanchez-Reilly et al., 2013).

4.3 Teamwork as a factor supporting psychological well-being

General practice teams are working units that can act as a stress-protective factor. We showed ‘sense of community’ to significantly influence the change of job satisfaction from baseline to follow-up data assessment (t=2.67, b=0.14) (Degen et al., 2022). This is in line with findings from different studies which showed teamwork as a significant predictor of job satisfaction among hospital employees in Canada (OR= 2.22, CI 1.57-4.16) (Krueger et al., 2017) and Taiwan (p<.001, R^2=0.63) (Chang et al., 2009). Our IMPROVE*job* study provided important data to better understand the positive value of well-functioning teams on job satisfaction among general practice teams.

Strong associations between good teamwork, good communication and work processes are shown. According to Hung et al., work redesign processes led to higher levels of teamwork among physicians and non-physician staff in 46 primary care departments (Hung et al., 2018). A qualitative study from New Zealand highlighted the importance of open communication in the practice team and good practice organization for establishing good teamwork (Pullon et al., 2009). In addition, Sorensen et al. showed in a recently published narrative review that especially the quality of communication in multi-professional teams is crucial to reduce the experience of team stress (Sorensen et al., 2022) which is of high interest as communication is shown to be a major facilitator of good teamwork in general practices (McInnes et al., 2015).

Furthermore, studies show associations between teamwork and patient outcomes. Rosen showed an association between teamwork and various adverse patient outcomes (Rosen

et al., 2018). In contrast, good teamwork is linked to higher patient satisfaction with care (Lyu et al., 2013). Team competencies in healthcare can be improved systematically through various team training and on-the-job approaches (Rosen et al., 2018). These findings support the need for interventions on communication skills and other teambuilding strategies like IMPROVE*job*. It is crucial to respect the importance of teamwork and team culture as factors supporting psychological well-being of general practice teams and the quality of patient care.

4.4 Strengths and limitations

It was an essential strength of the IMPROVE*job* intervention that it was developed using a participatory approach with professionals from the disciplines of general practice, occupational medicine, operations research and health promotion. In addition, the study was designed as a cluster-randomised controlled trial with an innovative leadership-based approach using skills trainings and various theoretical inputs to address a highly burdened target group. A large sample size of 60 general practices, when compared to previous intervention studies in this field, was included at baseline. The intervention was very well accepted and rated by the participants, especially by the practice leaders which shows the importance of well-tailored leadership interventions in this primary care setting. Furthermore, the application of an implementation phase with the so-called IMPROVE*job* facilitators can be regarded as a methodological strength.

Unfortunately, no significant effect of the intervention was detected at follow-up. This is likely due to the Covid-19 pandemic, which occurred in March 2020, just after baseline data collection. Based on our qualitative data, published in publication 2, the pandemic with its high emotional and quantitative work demands for general practice teams likely counteracted any positive effects of the IMPROVE*job* intervention. Although the sample size of the IMPROVE*job* study was rather large, generalizations to the general population of GPs have to be handled carefully.

4.5 Conclusion

The participatory, multimodal intervention was highly rated by the participating physicians and practice assistants. This suggests that the content and format of the intervention was appropriate for the target group. Future research projects can build on this experience. As shown, general practice is a complex work environment with many factors influencing the health of the workforce. In the literature, leadership was shown to be the most important predictor of job satisfaction in different settings. Unfortunately, probably due to the influence of the Covid-19 pandemic, we have not been able to show this influence in a GP setting properly. Consequently, there is a need for further leadership intervention studies to address this multi-parameter scenario aiming at improving job satisfaction and reducing chronic stress in general practice teams taking different factors, such as leadership, into account. There is also a need for future studies to investigate associations between the health of general practice teams and the quality of care. At an educational level, leadership trainings for medical students and even for physicians with leadership responsibility should be implemented to a greater extent. Stronger leaders in primary care will strengthen the health of general practice teams in the long term.

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