BMJ Open

Group Practice Impacts on Patients, Physicians, and Healthcare Systems: A Scoping Review

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-041579
Article Type:	Original research
Date Submitted by the Author:	22-Jun-2020
Complete List of Authors:	Zwiep, Terry; London Health Sciences Centre, Ahn, San (Hilalion); The Ottawa Hospital, Surgery Brehaut, Jamie; Ottawa Hospital Research Institute, Clinical Epidemiology Program Balaa, Fady; The Ottawa Hospital McIsaac, Daniel; The Ottawa Hospital, Anesthesiology and Pain Medicine Rich, Susan; The Ottawa Hospital Wallace, Tom; The Ottawa Hospital, Surgery Moloo, Husein; The Ottawa Hospital, Surgical Oncology; The Ottawa Hospital Research Institute , Clinical Epidemiology Program
Keywords:	HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisation of health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Group Practice Impacts on Patients, Physicians, and Healthcare Systems: A Scoping Review

Terry M Zwiep, The Ottawa Hospital, Ottawa, Ontario, Canada
San (Hilalion) Ahn, The Ottawa Hospital, Ottawa, Ontario, Canada
Jamie Brehaut, Ottawa Hospital Research Institute, Ottawa, Ontario, Canada
Fady Balaa, The Ottawa Hospital, Ottawa, Ontario, Canada
Daniel I McIsaac, The Ottawa Hospital, Ottawa, Ontario, Canada
Susan Rich, The Ottawa Hospital, Ottawa, Ontario, Canada
Tom Wallace, The Ottawa Hospital, Ottawa, Ontario, Canada
Husein Moloo, The Ottawa Hospital, Ottawa, Ontario, Canada

Corresponding Author: Terry Zwiep
The Ottawa Hospital – Civic Campus
305 – 737 Parkdale Ave.
Ottawa ON K1J 4E9
Phone: (613) 798-5555 x13963
Fax: (613) 761-4310
terry.zwiep@lhsc.on.ca

ABSTRACT

Objective: To identify the advantages and disadvantages that group practices have on patients, physicians, and healthcare systems.

Study design: A scoping review was performed based on the methodology proposed by Arksey and O'Malley, and refined by Levac and colleagues. Titles and abstracts were screened by two reviewers. A quantitative analysis was performed to assess the type, year, and region of publication as well as the population studied. A qualitative descriptive analysis was performed to identify common themes.

Study setting: MEDLINE, EMBASE, and Cochrane databases were searched for papers which assessed outcomes relevant to the research question.

Results: Our search strategy returned 2408 papers and 98 were included in the final analysis. Most papers were from the United States, were surveys, and assessed physician outcomes. Advantages of group practices for patients included improved satisfaction and quality of care. Studies of physicians reported improved quality of life and income, while disadvantages included increased stress due to poor interpersonal relationships. Studies of healthcare systems reported improved efficiency and better utilization of resources.

Conclusions: Group practices have many benefits for patients and physicians. Most data was of relatively low quality, however, and further work needs to be done assessing patient outcomes.

Strengths and limitations of this study:

- This was a large, comprehensive overview of group practices from many countries

- The scoping review methodology allowed us to assess a wide variety of papers and identify key gaps in the knowledge for further study
- Patient engagement was instrumental on focusing this review on patient outcomes and areas for improvement
- This review was limited by language restrictions, heterogeneity of the data, and possible publication bias

INTRODUCTION

Group practices have existed for over 100 years with one of the first groups set up by the Mayo brothers in the mid-1880s[1]. This group was eventually transformed into a large organization that has been recognized as a center of excellence leading to benefits for patients and physicians. Following their success, group practices became more and more common, and currently, many physicians around world are practicing within groups or partnerships[2–5]. Sizes of group practices vary dramatically, from 2 physicians to over 100 physicians, and there is no standard definition of what defines a group. Over the years many papers have been published on group practice formation assessing various advantages and disadvantages for patients, physicians, and healthcare systems as well as the impetus behind their development. The economic benefits of these groups and the improvements in service provision to patients is supported by the literature and has been well documented[3,6–8]. Barriers to the formation of group practices, or conflicts that can result from group practices have also been considered and often have to do with interpersonal relationships[9–12]. The extent of literature spans many decades and provides an excellent overview of how group practices have evolved and the effects which they have had on patients, physicians, and healthcare systems.

Patient care can be significantly altered by the formation of group practices, and it is important to consider this impact as groups are often formed for reasons that are not directly related to patient care[11,13–15]. Some of these other reasons include the benefits realized by physicians with regards to income, quality of life, satisfaction, and decreased physician burnout, which is estimated to affect more than half of physicians [9,16–19]. Group practices also may be developed due to healthcare system incentives, or as a way to improve the income and efficiency of physicians within a given system[14,20–23]. This again may not be directly related to patient care

but may have impacts on the quality of care and its timeliness. Whatever the motivation for forming group practices, it is important to assess the effects on all involved stakeholders to ensure that this is a step in the right direction for the patients that we are committed to serve, the wellbeing of physicians, and the sustainability of the systems which we work within.

There has been a paucity of literature that synthesizes the knowledge published regarding group practices. A systematic review published in 2013 assessed the effectiveness of group versus solo practice amongst general practitioners (GPs) and demonstrated a positive association between group practices and clinical processes, physicians opinions, and innovation, but did not observe any effect for patient measures[7]. A recent review has also attempted to establish a definition for group practices and the overall shift towards their development[24]. The objectives of this study were to review the literature for evidence that assesses the advantages and disadvantages that group practices have on patients with regards to quality of care and satisfaction; physicians with regards to team dynamics, income, and satisfaction; and the financial impact on healthcare systems. A scoping review was performed as we expected to identify heterogenous studies with a wide range of outcomes focused on patients, physicians, and healthcare systems. A broad overview of the literature was desired to identify current knowledge gaps and guide further studies.

METHODOLOGY

A scoping review was performed according to the methodology proposed by Arksey and O'Malley, and refined by Levac and colleagues[25,26]. The PRISMA extension for scoping reviews (PRISMA-ScR) checklist was used to ensure all relevant aspects of a scoping review were included[27]. The following research question was developed:

What advantages and disadvantages do group practices have for patients, physicians, and healthcare systems?

A complete scoping review protocol was developed and published[28]. The following stages were incorporated into this scoping review according to what is suggested by Levac et al.: identifying the research question; identifying relevant studies; study selection; charting the data; collating, summarizing, and reporting results; and consultation. Full details on each stage can be found in the published protocol[28]. Briefly, MEDLINE, EMBASE and Cochrane Central were searched to identify relevant studies that assess the impact of group practices on patient care, satisfaction, and outcomes; physician quality of life, satisfaction, and income; and healthcare system finances. There were no restrictions placed on publication date. The grey literature was not searched as originally indicated in the protocol due to an adequate number of peer-reviewed articles which met inclusion criteria from the databases. The search strategy was peer reviewed according to the formal process outlined by McGowan et al[29]. The search strategy is included in Appendix A.

Three members of the research team met to perform a calibration exercise and review 10 papers to pilot the screening and full text data extraction forms. Titles and abstracts were subsequently screened independently by two reviewers and the abstraction results from the full text articles were charted and verified by the same two members. Disagreements were resolved by discussion between the two reviewers as well as input from other authors of the paper. We included papers that:

- Included patients receiving, and/or clinicians providing care within any type of group practice (Population)

- Assessed the advantages and/or disadvantages of group practices (Concept)

- We examined all papers from group practices in all areas of medicine which reported outcomes relevant to patients, clinicians, or health system stakeholders (Context)

Papers were excluded if they were not published in the English language.

DistillerSR (Evidence Partners, Ottawa, Canada) was used for screening and data extraction. A standardized form was created and tested on 10 papers by three members of the research team. We did not deviate from the protocol and charted authors, year of publication, country of origin, objectives, type and size of group practice, population studied (patients, physicians, etc.), sample size, methods and type of study, interventions, outcomes, and key findings[28].

We extracted and summarized included paper characteristics including type of study, year, region of publication, and the population studied. A qualitative analysis was also performed using a qualitative descriptive approach from the key findings of the selected papers[30]. This was performed in parallel by two reviewers who then met to discuss the results and corresponding themes. After a conventional content analysis, common themes were grouped by:

1) patient care, including satisfaction and quality of care

2) physicians, including quality of life, competency, group dynamics, group characteristics, and financial impacts

3) healthcare system issues relating to financial impacts

A detailed quality assessment was not performed due to the heterogeneity of the data and the general principles of a scoping review[26]. During the scoping review process, we consulted with members of other group practices to ensure that the review was comprehensive and that all relevant papers were included.

Patient and Public Involvement

A patient advisor was recruited from the Department of Patient Relations as part of the research team. As practice organization directly impacts on patients, it was essential that we had patient input into the design of the study and the analysis of the data. The patient advisor ensured that the research question and outcomes were applicable to patients and reviewed the final draft of the paper.

RESULTS

Using the search strategy outlined in Supplementary Appendix A, 2408 papers were identified. Of these, 35 were excluded as duplicates and 2373 titles and abstracts were screened. After screening, 149 full text articles were examined and 98 met inclusion criteria. Of those excluded, 34 did not assess advantages or disadvantages of group practices, 5 papers focused on multidisciplinary groups, 2 papers were based on a previous paper and did not provide any new data, and 1 paper assessed a dental group practice. We were unable to obtain full text articles for 9 papers. The PRISMA flow diagram in Figure 1 displays these results.

The majority of papers were from the United States (58%), followed by Europe (19%), and then Canada (15%). There were only a handful of papers from elsewhere in the world (7%). Papers frequently included more than one type of group practice. Family medicine was reported on most commonly (76%), followed by surgical practices (43%), and all others (36%). Physicians (94%) were the focus of almost all the papers rather than patients (26%), allied health (4%), or healthcare systems (10%). Some papers touched on multiple populations. Most of the included papers were surveys (63%). There were very few higher quality papers available which focused on group practices. Group practices have been published on dating back until at least the 1960s. Recurring themes were evident over the years and are expanded on in the qualitative analysis. See Table 1 for a full description of included papers.

Table 1 - Selected Paper Characteristics

Characteristic		Frequency
Region of Study	United States	57%
	Europe	20%
	Canada	16%
	Other	7%
Type of Group Practice	Family Medicine or General Practitioner	76%
	Surgical	43%
	Other	36%
Population Studied	Physicians	94%
	Patients	26%
	Healthcare Systems	10%
	Allied Health	4%
Type of Publication	Survey	63%
	Letter	7%

	Case Report	6%
	Cohort Study	5%
	Abstract	2%
	Case Series	2%
	RCT	2%
	Systematic Review	2%
	Other	10%
Publications by Decade	1960-1969	6
	1970-1979	9
	1980-1989	5
	1990-1999	9
	2000-2009	23
	2010-present	40

Group Practices Improve Patient Satisfaction and Experience

Sources that addressed patient outcomes are listed in Supplementary Appendix B. Six of these provided evidence that group practices can result in improvements in patient satisfaction[23,31–34]. Most of these sources were surveys that assessed changes in satisfaction after the implementation or expansion of a group practice. This sense of satisfaction appeared to be

most commonly due to better perceived access to care and quality of care. In contrast to this, one survey from 1975 identified a negative effect on patient satisfaction and experience[35]. The Patient Perceptions of Integrated Care survey identified that patients with multiple chronic diseases who perceive a higher level of integration within a group will utilize less emergency department and outpatient resources[36].

Patient Quality of Care

The aspects of quality of care assessed by the papers included access to care, continuity of care, prescribing techniques, adherence of the physicians with established clinical guidelines, frequency of consultations, and unnecessary investigations and treatment. Most sources either identified an improvement in patient quality of care associated with group practices or a negative impact on patient quality of care. Some sources did not identify any differences in patient quality of care based on practice organization[37,38].

Group Practices Improve Patient Quality of Care

Twenty-two sources demonstrated improvements in patient quality of care. This included objective measures with quality of care scores as well as patient perception as captured by surveys. Group practices were found to improve access to care, comprehensiveness, waiting times, time spent with patients, efficiency, patient safety, and utilization of resources according to patient reported outcomes[6,8,46,47,32,39–45]. Patients perceived a higher quality of care with group practices with regards to tangibles (equipment and facilities), reliability, responsiveness, assurance, and empathy[48]. Physicians in group practices had higher quality of care scores and adherence to guidelines was found to be better due to increased knowledge sharing and access to information[34,41,49,50]. Improvements in appropriate prescribing techniques were also associated with physicians working in group practices[7,51]. Physicians in group practices were also more

likely to consult peers[52]. More patient-centered medical home processes within a practice is associated with larger groups compared to solo and small group practices (1-2 physicians), although all types of practices have shown modest increases over time[53,54]. However, a recent paper based on large surveys found no improvements in quality measures based on practice size[55].

Group Practices Negatively Impact Patient Quality of Care

Six sources noted some negative impacts with group practices on patient quality of care. This included worse continuity of care and dilution of the patient-doctor relationship[47,56]. Group practices have also been found to order more investigations or treat inappropriately if there was a financial benefit[8,57,58]. Additionally, a primary care internist who moved from a small practice to a large group practice after many years perceived that the level of care he was providing was compromised by the large group and payers setting targets for the group[59].

Physician Quality of Life, Satisfaction, and Burnout

Papers which assessed physician outcomes are listed in Supplementary Appendix B. Twenty papers assessed the relationship between group practices and physician quality of life, satisfaction, and burnout. Two main themes were identified from the sources. Two papers did not find any significant difference in this area for group and solo practices[60,61].

Group Practices Improve Physician Quality of Life and Satisfaction

Group practices were often found to improve the work-life balance and job satisfaction for physicians when compared to solo practices[9,19,62–66]. Being a member of a group practice led to less professional isolation, improved knowledge sharing, and an improvement in professional development[9,19,67]. Improved attitudes about group practices in the Netherlands were related to an increased desire for contact and cooperation with other physicians[68]. Satisfaction with

personal and lifestyle factors and optimism for the future was increased amongst physicians in group practices[69,70]. Group practices were also associated with a decreased call burden and increased cross coverage of patients which directly impacts the quality of life for most physicians and their families[6,67]. Due to the aforementioned benefits, group practices have also been noted to improve retention and recruitment initiatives, especially in rural or underserviced areas[67,71].

Group Practices Lead to Conflict and Additional Stress for Physicians

Seven sources have identified issues with group practices that create conflict and additional stress for physicians. These center around the interpersonal relationships of the group members and sustainability[62]. Poor interpersonal relationships lead to lower job satisfaction and a higher degree of professional burnout[72,73]. Some group practices were also associated with increased physician demands, decreased performance, and reduced autonomy[73–75]. A large survey of family physicians in Canada found that physicians in solo practice had more job satisfaction than those in group practices in a survey that was primarily assessing improved satisfaction with performing procedures[76].

Group Practices Improve Physician Competency

Two papers addressed differences in physician competency. Family physicians and surgeons were found to be less likely to pass their respective maintenance of certification exams if they were in a solo practice. This was thought to result from the ability to spend more time on quality improvement and education within a group practice[77,78].

Facilitators and Barriers Associated with Working in a Group Practice

An important theme that arose during analysis was the identification of barriers and facilitators associated with forming or maintaining a group practice. These characteristics have

direct impacts on patient care and physician quality of life, job satisfaction, and burnout. Eight sources identified these characteristics and they are summarized in Table 2.

Table 2 - List of Barriers and Facilitators for Group Practices

Facilitators	Barriers
Teamwork	Incompatible personalities
Leadership	Poor leadership
Common vision	Different visions for the group
Patient centred care	Disagreements about re-imbursement
Quality improvement	Legal and real estate issues
Accountability	Dissatisfied office staff
Sense of ownership	Fears about loss of autonomy
Sense of responsibility	
Cohesiveness	

Financial Impacts for Physicians

Although there are some geographical variations based on different healthcare systems, some common financial themes can be seen in the literature (Supplementary Appendix B).

Group Practices Lead to Higher Incomes for Physicians

Sources from the United States, Taiwan, and South Africa have identified increased individual earnings for physicians practicing within group practices[15,21,70,79–82]. Physicians in group practices have also been shown to be more satisfied with their compensation. A letter published in 1968 highlighted income deferral by physicians until later in life when they were less productive as an additional benefit of group practices[83]. Currently, larger groups may be

forming in the United States as they are able to leverage insurers more effectively and build up more market share[3].

Costs of Group Practices are Higher than Solo Practices

Costs of group practices have been found to be higher than those of solo practices[20,84,85]. This may be due to more investment in technological costs that solo practices would not be able to afford[20,85]. Some large group practices may also be more inefficient than solo or small group practices[86].

Group Practices May Improve the Uptake of Health Information Technology

Physicians practicing in groups are more likely to have greater access to health information technology (HIT) and were also more likely to correspond with their patients and other providers via email[7,87]. Family physicians in the United States in solo practices were found to be less likely to adopt electronic health records when compared to those in group practices[88,89]. Data from two large surveys indicated a general trend towards increased use of HIT over time, but did not see a clear association between group size and an increased use of HIT[55].

More Physicians are Practicing in Group Practices and Group Practices are Increasing in Size

Many sources have tracked the rise in the number and type of group practices over the years (Supplementary Appendix B). The definition of a group practice is very heterogenous in the literature and previous work has been done in an attempt to classify groups[24]. Often, groups of 1-19 physicians are classified as small or medium (further subclassified into groups of 1-2, 3-7, 8-12, and 13-19), and groups of 20 or more are classified as large (further subclassified into groups of 20-99 and >100).[53,54] The included papers show an increase in the absolute number of group practices and their sizes over the years.

In 1968, group practices were mostly limited to hospitals with most other physicians working in solo practices outside of the hospitals, and it was believed that group practices would not be taken up unless it was established as a desirable form of practice to society and health care professionals[90,91]. Now, in the United States, more physicians across all specialties are forming or joining larger groups and groups of more than 100 physicians which usually have non-physician owners, have grown rapidly in recent years[2–4]. This increase has been driven by the benefits group practices can offer physicians[11,13,92–95].

Despite having a very different healthcare system, group practices have also grown in Canada. In 1970, 57% of graduating physicians entered a group practice or partnership, 21% entered solo practice, and 22% became salaried physicians. Surgeons and psychiatrists were most likely to enter solo practice[5]. A survey of Canadian physicians in 1987 found that around half of the physicians were in either solo or group practices and the other half had some group practice arrangements for financial benefits[14]. Government support was seen as a key factor in establishing group practices[14,96].

Group Practices May Help Reduce Costs Within Healthcare Systems

Group practices have the potential to impact healthcare systems financially, with respect to access to care, and appropriate utilization of healthcare resources. Sources have shown that group practices of all sizes and most specialties have been shown to have more technical, cost, and profit efficiencies than solo practices (Supplementary Appendix B)[97,98]. This is thought to be due to the standardization of processes[98]. Group practices that focus on improved screening and monitoring may improve avoidable utilization, cost, and revenue[97]. A higher level of integration perceived by patients with chronic illnesses also reduces utilization of emergency department and outpatient resources[36]. Income pooling within an obstetrical call group in a Canadian study

led to decreased rates of elective induction of labour in a before and after study[99]. Older data from the Physicians' Practice Cost and Income Survey in 1986 found no significant differences in practice efficiency between solo and group primary care practices in the United States[100]. Additionally, a recent paper which included data from large surveys found that group size was not associated with an improvement in spending or quality[55].

DISCUSSION

We were able to identify themes associated with the advantages and disadvantages that group practices have for patients, physicians, and healthcare systems. It is important to note that the term 'group practice' refers to a broad range of practice types within the literature and there is no clear definition with respect to the critical pieces that define what a group practice is beyond the number of physicians and inclusion of one or more specialties. Organizations in the United States such as the America's Physician Groups, and American Medical Group Association have been developed to represent physicians in various types of groups. Groups may be defined as single specialty with two or more physicians or multispecialty with any number of different specialties providing care to patients.

Themes involving patients included satisfaction and quality of care. Generally, patients seemed to be more satisfied with care that was being received from physicians in group practices[23,31,32,46]. From these studies, this appears to be due to increased access to care and decreased waiting times. Although continuity of care would seem to be a legitimate concern with a group practice as patients may be seeing different physicians on any given day, this was actually shown to be improved in one study[23]. Furthermore, in a situation that is unique to a surgical group practice, patients did not seem to be concerned by the fact that they might not

meet the surgeon who is operating on them until the day of their operation as they had confidence in any of the surgeons associated with the group[32].

While it is important that patients are satisfied with the care they are receiving, it is imperative that they also receive high quality care. Overall, most papers indicated that the quality of care increased with a group practice structure as measured objectively and subjectively. Adherence to guidelines and appropriate prescribing was better with group practices and quality of care scores improved[7,50,51]. There were some notable exceptions including using radiation therapy for prostate cancer when it was not necessarily indicated because the group owned radiation facilities, and the increased use of laboratory investigations offered by the group[15,57,58]. This may have been driven by convenience as well as financial gain.

Overall, patients appear to benefit from group practices through improved quality of care, access, and satisfaction. The data surrounding the impact of group practices on patients was presented in 24 percent of papers. This has been identified as an area for further research as we know that group practices are often formed to primarily benefit the physicians working within them[6,67,71].

Numerous advantages of group practices for physicians have been identified from this scoping review. They include increased quality of life and satisfaction, decreased burnout, higher competency, and financial gain. More attention has been paid to physician burnout in recent years as the prevalence is surprisingly high[17,18]. Improving the quality of life and job satisfaction for physicians may help with this and group practices have the potential to help in these areas.

Overall, most of the literature included in this review shows a positive association with group practices and physician quality of life and job satisfaction. These improvements result from a better work-life balance, shared call responsibilities, improved knowledge transfer,

collaboration, and decreased professional isolation[6,9,62,65]. Physicians in solo practices may still be able to pursue similar opportunities but may face logistical challenges due to isolation.

A notable area of decreased satisfaction results from poor interpersonal relationships[12,22]. This can lead to the collapse of a group and highlights the need for group practice members to be compatible and share a common vision, especially if they are financially integrated. As groups become larger and larger, especially in the United States where groups of more than 100 physicians are not uncommon, relationships can become less collegial and autonomy may be lost[101]. The importance of regular meetings with a shared sense of ownership and responsibility has been shown to be very important to group function and quality of care[102,103]. Therefore, although groups have the potential to improve job satisfaction and quality of life for physicians, it depends on the overall functioning of the group and compatible personalities within the group for this to be achieved.

In the two papers assessing the level of physician competency (based on whether or not physicians were members of group practices) the overall impact seems to be positive with improved scores on certification exams[77,78]. This is thought to be due to more knowledge transfer between group members and less professional isolation. The ability to approach and consult colleagues relatively easily about difficult or interesting clinical questions has the potential to enhance the learning of all group members and improve patient care.

Financially, group practices have been shown to improve incomes of physicians. This is most relevant in the United States where groups are often formed to gain negotiating leverage with payers[11,13]. However, individual incomes also seem to be higher in other areas of the world such as New Zealand, South Africa, and Taiwan[70,80,81]. The increased income may help offset

costs associated with investments in equipment or technology that would not be feasible for solo physicians.

The impact of group practices on healthcare systems can be seen in improvements in access to care, system efficiencies, improved use of resources, and adherence to guidelines. Some exceptions to this may include inappropriate use of resources if there is a financial gain. Moving forward, this will be an important area of study as there are many different health care systems in place around the world.

As part of the scoping review process, key stakeholders were consulted regarding this review. They included a patient advisor and members of other group practices. The patient advisor was included in the design of this study and verified the results. Other group practice members verified the results and will help to guide further research in the future. Some of the authors of this paper are group practice members and will be using their practice for research that will focus on patient outcomes including quality of care and satisfaction, as well as physician outcomes including quality of life, satisfaction, and burnout with guidance from this scoping review.

There are inherent limitations with a scoping review. This was meant to be a broad overview of the available literature and as such, the data is heterogenous and does not lend itself well to a quality assessment. Most of the included papers were surveys and of lower quality. There may very well be a publication bias with this topic as authors may only be inclined to publish on group practices that have worked very well. The included papers were also from many different regions and therefore, the conclusions may not be applicable to a particular country or region, however the objective of this review was to assess the advantages and

disadvantages of group practices and common themes were identified that likely transcend many regional differences.

CONCLUSION

A group practice structure has many advantages for patients and physicians alike. Although the data is somewhat limited for patients compared to physicians, this scoping review has shown that there is a generally positive patient experience with some evidence of improved quality of care. There is also an increase in physician satisfaction and quality of life in groups that function well with compatible personalities. This scoping review has summarized the available literature based on our research question and has allowed us to identify two interesting areas of future investigation. First, it will be important to define exactly what the critical elements of a group practice are beyond the number of physicians as there is no standard definition that we were able to discern in this scoping review. This may then be used to guide the development of functional groups that are able to improve care and quality of life for both patients and providers. Second, although most of the available literature is directed towards the impact of group practices on physicians, addressing patient outcomes and perspectives is essential. This has been addressed in the literature more recently, and is an area which should be further developed.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

ACKNOWLEDGEMENTS

We would like to acknowledge Risa Shorr and Josée Skuce for their help in developing the search strategy and obtaining full texts articles for this scoping review.

CONTRIBUTORS

HM, TZ, DM, and FB conceived the study. TZ and HM drafted the protocol and developed the research question. TZ and SA performed the title and abstract screening and full text data extraction. TZ, HM, JB, TW, and SR contributed to the thematic analysis and interpretation of the data. All authors read and approved the final manuscript. HM is the guarantor.

REFERENCES

1. W. Bruce Fye WB. Presidential Address: The Origins and Evolution of the Mayo Clinic from 1864 to 1939: A Minnesota Family Practice Becomes an International "Medical Mecca" *Bull Hist Med*. 2010;84(3):323-357.

2. Muhlestein DB, Smith NJ. Physician Consolidation: Rapid Movement From Small To Large Group Practices, 2013-15. *Health Aff (Millwood)*. 2016;35(9):1638-1642.

3. Burns LR, Goldsmith JC, Sen A. Horizontal and vertical integration of physicians: a tale of two tails. *Adv Health Care Manag*. 2013;15:39-117.

4. Liebhaber A, Grossman JM. Physicians moving to mid-sized, single-specialty practices. *Track Rep*. 2007;(18):1-5.

5. Paulick JM, Roos NP. The young physician: types of practice. *Can Med Assoc J*. 1978;118(3):276-278.

6. Breon TA. Rural Surgical Practice: An Iowa Group Model. *Surg Clin North Am*. 2009;89(6):1359-1366.

7. Damiani G, Silvestrini G, Federico B, et al. A systematic review on the effectiveness of

group versus single-handed practice. *Health Policy*. 2013;113(1-2):180-187.

8. Devlin RA, Hogg W, Zhong J, Shortt M, Dahrouge S, Russell G. Practice size, financial sharing and quality of care. *BMC Health Serv Res*. 2013;13(1):446.

9. Feron J-M, Cerexhe F, Pestiaux D, et al. GPs working in solo practice: obstacles and motivations for working in a group? A qualitative study. *Fam Pract*. 2003;20(2):167-172.

10. Hays RB, Sanderson L. Forming large group practices: is it worth it? *Med J Aust*. 1994;161(8):494-496.

11. Casalino LP, Devers KJ, Lake TK, Reed M, Stoddard JJ. Benefits of and Barriers to Large Medical Group Practice in the United States. *Arch Intern Med*. 2003;163(16):1958.

12. Crane HS, Dennis DA. Risks of a large group practice: a personal experience. *Clin Orthop Relat Res*. 2003;(407):67-70.

13. Casalino LP, Pham H, Bazzoli G. Growth Of Single-Specialty Medical Groups. *Health Aff*. 2004;23(2):82-90.

14. Williams AP, Vayda E, Stevenson HM, Burke M, Pierre KD. A typology of medical practice organization in Canada. Data from a national survey of physicians. *Med Care*. 1990;28(11):995-1004.

15. Bailey RM. A comparison of internists in solo and fee-for-service group practice in the San Francisco Bay area. *Bull N Y Acad Med*. 1968;44(11):1293-1303.

16. Rothenberger DA. Physician Burnout and Well-Being: A Systematic Review and Framework for Action. *Dis Colon Rectum*. 2017;60(6):567-576.

17. West CP, Dyrbye LN, Erwin PJ, Shanafelt TD. Interventions to prevent and reduce

physician burnout: a systematic review and meta-analysis. *Lancet*. 2016;388(10057):2272-2281.

18. Shanafelt TD, Hasan O, Dyrbye LN, et al. Changes in Burnout and Satisfaction With Work-Life Balance in Physicians and the General US Working Population Between 2011 and 2014. *Mayo Clin Proc*. 2015;90(12):1600-1613.

19. Romano M. United we do quite well, thank you. Survey: physicians say practicing in groups is a better way to provide care. *Mod Healthc*. 2001;31(12):34.

20. Heimeshoff M, Schreyögg J, Kwietniewski L. Cost and technical efficiency of physician practices: a stochastic frontier approach using panel data. *Health Care Manag Sci*. 2014;17(2):150-161.

21. Kwietniewski L, Schreyögg J. Profit efficiency of physician practices: a stochastic frontier approach using panel data. *Health Care Manag Sci*. 2018;21(1):76-86.

22. Rodríguez C, Pozzebon M. The implementation evaluation of primary care groups of practice: a focus on organizational identity. *BMC Fam Pract*. 2010;11(1):15.

23. Tourigny A, Aubin M, Haggerty J, et al. Patients' perceptions of the quality of care after primary care reform: Family medicine groups in Quebec. *Can Fam Physician*. 2010;56(7):e273-82.

24. Kash B, Tan D. Physician Group Practice Trends : A Comprehensive Review. *J Hosp Med Manag*. 2016;2(1:3):1-8.

25. Arksey H, O'Malley L. Scoping studies: Towards a methodological framework. *Int J Soc Res Methodol Theory Pract*. 2005;8(1):19-32.

26. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci*. 2010;5(1):69.

27. Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2018;169(7):467-473.

28. Zwiep TM, Greenberg JA, Balaa F, et al. Impact of group practices on patients, physicians and healthcare systems: protocol for a scoping review. *BMJ Open*. 2018;8(9):e022164.

29. McGowan J, Sampson M, Salzwedel DM, Cogo E, Foerster V, Lefebvre C. PRESS Peer Review of Electronic Search Strategies: 2015 Guideline Statement. *J Clin Epidemiol*. 2016;75:40-46.

30. Colorafi KJ, Evans B. Qualitative Descriptive Methods in Health Science Research. *HERD Heal Environ Res Des J*. 2016;9(4):16-25.

31. Gawande SR, Benroth R. Comparison of patient satisfaction results during a period of rapid growth for a specialty group practice. *Am J Orthop (Belle Mead NJ)*. 1999;28(4):236-238.

32. van den Heuvel B, Vair B, Porter G, Klassen D, Inglis K, Bonjer HJ. Patient compliance with a group model of care: the hernia clinic. *Can J Surg*. 2012;55(4):259-263.

33. Cohidon C, Wild P, Senn N. Patient experience in primary care: association with patient, physician and practice characteristics in a fee-for-service system. *Swiss Med Wkly*. 2018;148(1314):w14601.

34. Ellis SD, Karim SA, Vukas RR, Marx D, Uddin J. Four Needles in a Haystack: A Systematic Review Assessing Quality of Health Care in Specialty Practice by Practice

Type. *Inquiry*. 2018;55:46958018787041.

35. Ritchey FJ. Solo and Group Physician Practices, Family-Physician Relationships and Unmet Critical Health Need in Rural Areas. In: *Annual Meeting of the Southwestern Sociological Association*. San Antonio; 1975.

36. Fryer A-K, Friedberg MW, Thompson RW, Singer SJ. Patient perceptions of integrated care and their relationship to utilization of emergency, inpatient and outpatient services. *Healthcare*. 2017;5(4):183-193.

37. Visca M, Donatini A, Gini R, et al. Group versus single handed primary care: a performance evaluation of the care delivered to chronic patients by Italian GPs. *Health Policy*. 2013;113(1-2):188-198.

38. Roos NP. Impact of the organization of practice on quality of care and physician productivity. *Med Care*. 1980;18(4):347-359.

39. Gaal S, van den Hombergh P, Verstappen W, Wensing M. Patient safety features are more present in larger primary care practices. *Health Policy (New York)*. 2010;97(1):87-91.

40. Xierali IM. Physician Multisite Practicing: Impact on Access to Care. *J Am Board Fam Med*. 2018;31(2):260-269.

41. Stol DM, Hollander M, Nielen MMJ, Badenbroek IF, Schellevis FG, de Wit NJ. Implementation of selective prevention for cardiometabolic diseases; are Dutch general practices adequately prepared? *Scand J Prim Health Care*. 2018;36(1):20-27.

42. Bardos J, Loudon H, Rekawek P, Friedman F, Brodman M, Fox N. The Association between Solo versus Group Obstetrical Practice Model and Delivery Outcomes. *Am J*

Perinatol. 2018.

43. Ly DP, Glied SA. Variations in the service quality of medical practices. *Am J Manag Care*. 2013;19(11):e378-85.

44. Orrantia E. Marathon works. How to thrive in rural practice. *Can Fam Physician*. 2005;51:1217-1221.

45. Campbell JL, Ramsay J, Green J. Practice size: impact on consultation length, workload, and patient assessment of care. *Br J Gen Pract*. 2001;51(469):644-650.

46. Cohen DI, Breslau D, Porter DK, et al. Academic group practice. The patient's perspective. *Med Care*. 1986;24(11):990-998.

47. Graham FE. Group versus solo practice: arguments and evidence. *Inquiry*. 1972;9(2):49-60.

48. Lin H-C, Xirasagar S, Laditka JN. Patient perceptions of service quality in group versus solo practice clinics. *Int J Qual Heal care J Int Soc Qual Heal Care*. 2004;16(6):437-445.

49. Perkins RB, Anderson BL, Gorin SS, Schulkin JA. Challenges in cervical cancer prevention: a survey of U.S. obstetrician-gynecologists. *Am J Prev Med*. 2013;45(2):175-181.

50. Ashworth M, Armstrong D. The relationship between general practice characteristics and quality of care: a national survey of quality indicators used in the UK Quality and Outcomes Framework, 2004-5. *BMC Fam Pract*. 2006;7(1):68.

51. Pichetti S, Sermet C, Godman B, Campbell SM, Gustafsson LL. Multilevel analysis of the influence of patients' and general practitioners' characteristics on patented versus

multiple-sourced statin prescribing in France. *Appl Health Econ Health Policy*. 2013;11(3):205-218.

52. Kuyvenhoven MM, Pieters HM, Jacobs HM, Touw-Otten FW, Spreeuwenberg C. Do peer consultations improve quality of care in general practice? *Qual Assur Heal care Off J Int Soc Qual Assur Heal Care*. 1990;2(2):171-179.

53. Rittenhouse DR, Casalino LP, Shortell SM, et al. Small and medium-size physician practices use few patient-centered medical home processes. *Health Aff (Millwood)*. 2011;30(8):1575-1584.

54. Wiley JA, Rittenhouse DR, Shortell SM, et al. Managing chronic illness: physician practices increased the use of care management and medical home processes. *Health Aff (Millwood)*. 2015;34(1):78-86.

55. Baker LC, Pesko M, Ramsay P, Casalino LP, Shortell SM. Are Changes in Medical Group Practice Characteristics Over Time Associated With Medicare Spending and Quality of Care? *Med Care Res Rev*. November 2018:107755871881293.

56. Freemyer B, Stoff B. Ethical challenges with treating nonadherent patients in a group practice setting. *J Am Acad Dermatol*. 2018;79(3):596-598.

57. Sellers EM. The influences of group and independent general practice on patient care: A comparative study in Ontario. *Can Med Assoc J*. 1965;93:147-157.

58. Hollenbeck BK, Kaufman SR, Yan P, et al. Urologist Practice Affiliation and Intensity-modulated Radiation Therapy for Prostate Cancer in the Elderly. *Eur Urol*. 2018;73(4):491-498.

59. Landon BE. Use of quality indicators in patient care: a senior primary care physician trying to take good care of his patients. *JAMA*. 2012;307(9):956-964.

60. Pasternak DP, Tuttle WC, Smith HL. Physician satisfaction in group practice: a comparison of primary care physicians with specialists. *GHAA J*. 1986;7(1):50-59.

61. Viehmann A, Kersting C, Thielmann A, Weltermann B. Prevalence of chronic stress in general practitioners and practice assistants: Personal, practice and regional characteristics. De Socio GV, ed. *PLoS One*. 2017;12(5):e0176658.

62. Koppula S, Brown JB, Jordan JM. Experiences of Family Physicians Who Practise Primary Care Obstetrics in Groups. *J Obstet Gynaecol Canada*. 2011;33(2):121-126.

63. Hueston WJ. Family physicians' satisfaction with practice. *Arch Fam Med*. 1998;7(3):242-247.

64. Dowell AC, Hamilton S, McLeod DK. Job satisfaction, psychological morbidity and job stress among New Zealand general practitioners. *N Z Med J*. 2000;113(1113):269-272.

65. Streu R, Hawley S, Gay A, Salem B, Abrahamse P, Alderman AK. Satisfaction with Career Choice among U.S. Plastic Surgeons: Results from a National Survey. *Plast Reconstr Surg*. 2010;126(2):636-642.

66. Nørøxe KB, Pedersen AF, Bro F, Vedsted P. Mental well-being and job satisfaction among general practitioners: a nationwide cross-sectional survey in Denmark. *BMC Fam Pract*. 2018;19(1):130.

67. Connor RA, Hillson SD, Kralewski JE. An analysis of physician recruitment strategies in rural hospitals. *Health Care Manage Rev*. 1995;20(1):7-18.

68. Verbeek-Heida PM. General practitioners' attitudes towards group practice in the Netherlands. *Soc Sci Med*. 1969;3(2):249-258.

69. Stamps PL. Physicians and organizations: an uneasy alliance or a welcome relief? *J Fam Pract*. 1995;41(1):27-32.

70. Moosa S, Luiz J, Carmichael T, Peersman W, Derese A. Insights of private general practitioners in group practice on the introduction of National Health Insurance in South Africa. *African J Prim Heal Care Fam Med*. 2016;8(1).

71. Evashwick CJ. The role of group practice in the distribution of physicians in nonmetropolitan areas. *Med Care*. 1976;14(10):808-823.

72. Streu R, Hansen J, Abrahamse P, Alderman AK. Professional burnout among US plastic surgeons: results of a national survey. *Ann Plast Surg*. 2014;72(3):346-350.

73. Orton P, Orton C, Pereira Gray D. Depersonalised doctors: a cross-sectional study of 564 doctors, 760 consultations and 1876 patient reports in UK general practice. *BMJ Open*. 2012;2(1):e000274.

74. Mahoney AR. Factors affecting physicians' choice of group or independent practice. *Inquiry*. 1973;10(2):9-18.

75. Mosaly PR, Mazur LM, Jones EL, et al. Quantifying the impact of cross coverage on physician's workload and performance in radiation oncology. *Pract Radiat Oncol*. 2013;3(4):e179-86.

76. Rivet C, Ryan B, Stewart M. Hands on: is there an association between doing procedures and job satisfaction? *Can Fam Physician*. 2007;53(1):93, 93:e.1-5, 92.

77. Schulte BM, Mannino DM, Royal KD, Brown SL, Peterson LE, Puffer JC. Community size and organization of practice predict family physician recertification success. *J Am Board Fam Med*. 2014;27(3):383-390.

78. Valentine MA, Barsade S, Edmondson AC, Gal A, Rhodes R. Informal Peer Interaction and Practice Type as Predictors of Physician Performance on Maintenance of Certification Examinations. *JAMA Surg*. 2014;149(6):597-603.

79. Lowes R. Group practices pay better. *Med Econ*. 2007;84(22):23-25.

80. Lin H-C, Chen C-S, Liu T-C, Lee H-C. Differences in practice income between solo and group practice physicians. *Health Policy (New York)*. 2006;79(2-3):296-305.

81. McCormick IR, Thomson AN. What future for solo general practice? *N Z Med J*. 1989;102(877):530-532.

82. Graham JW. Comparisons of solo practices and group practices. *J Oral Surg*. 1979;37 Spec No A:A65-82.

83. Rose I. Aspects of group medical practice. *Can Med Assoc J*. 1968;98(23):1118.

84. Davies S. General practice costs survey for financial year 1977/78. *N Z Med J*. 1979;90(639):20-23.

85. Kwietniewski L, Heimeshoff M, Schreyögg J. Estimation of a physician practice cost function. *Eur J Heal Econ*. 2017;18(4):481-494.

86. Kimbell LJ, Lorant JH. Physician productivity and returns to scale. *Health Serv Res*. 1977;12(4):367-379.

87. Mazurenko O, Hearld LR, Menachemi N. The relationship between the external

environment and physician e-mail communication: The mediating role of health information technology availability. *Health Care Manage Rev*. 2017;42(2):122-131.

88. Xierali IM, Phillips RL, Green LA, Bazemore AW, Puffer JC. Factors influencing family physician adoption of electronic health records (EHRs). *J Am Board Fam Med*. 2013;26(4):388-393.

89. Rao SR, DesRoches CM, Donelan K, Campbell EG, Miralles PD, Jha AK. Electronic health records in small physician practices: availability, use, and perceived benefits. *J Am Med Informatics Assoc*. 2011;18(3):271-275.

90. Terris M. Introduction: Origins and growth of group practice. *Bull N Y Acad Med*. 1968;44(11):1277-1281.

91. Weinerman ER. Problems and perspectives of group practice. *Bull N Y Acad Med*. 1968;44(11):1423-1434.

92. Sturm R. Effect of managed care and financing on practice constraints and career satisfaction in primary care. *J Am Board Fam Pract*. 2002;15(5):367-377.

93. Sturm R. The impact of practice setting and financial incentives on career satisfaction and perceived practice limitations among surgeons. *Am J Surg*. 2002;183(3):222-225.

94. Holden DM. Rural practice modes. *Acad Med*. 1990;65(12 Suppl):S32-40.

95. Schryver DL, Niederman GA, Johnson BA. Establishing a group practice "without walls". *Health Care Strateg Manage*. 1993;11(1):18-21.

96. Wallace JD. Group practice: the way of the future? *Can Med Assoc J*. 1974;111(6):571.

97. Kralewski J, Dowd B, Knutson D, Tong J, Savage M. The Relationships of Physician

Practice Characteristics to Quality of Care and Costs. *Health Serv Res*. 2015;50(3):710-729.

98. Kwietniewski L, Schreyögg J. Efficiency of physician specialist groups. *Health Care Manag Sci*. 2018;21(3):409-425.

99. Bland ES, Oppenheimer LW, Holmes P, Wen SW. The effect of income pooling within a call group on rates of obstetric intervention. *CMAJ*. 2001;164(3):337-339.

100. Defelice LC, Bradford WD. Relative inefficiencies in production between solo and group practice physicians. *Health Econ*. 1997;6(5):455-465.

101. Curoe A, Kralewski J, Kaissi A. Assessing the cultures of medical group practices. *J Am Board Fam Pract*. 2003;16(5):394-398.

102. Suchman A, Mainali E, Hoffer Gittel J. Society of General Internal Medicine 34th Annual Meeting ABSTRACTS OF SUBMISSIONS. In: *ADDRESSING CHRONIC CONFLICT AND PROBLEMATIC BEHAVIORS IN A GROUP PRACTICE*. ; 2011:S556.

103. Solberg LI, Hroscikoski MC, Sperl-Hillen JM, Harper PG, Crabtree BF. Transforming medical care: case study of an exemplary, small medical group. *Ann Fam Med*. 2006;4(2):109-116.

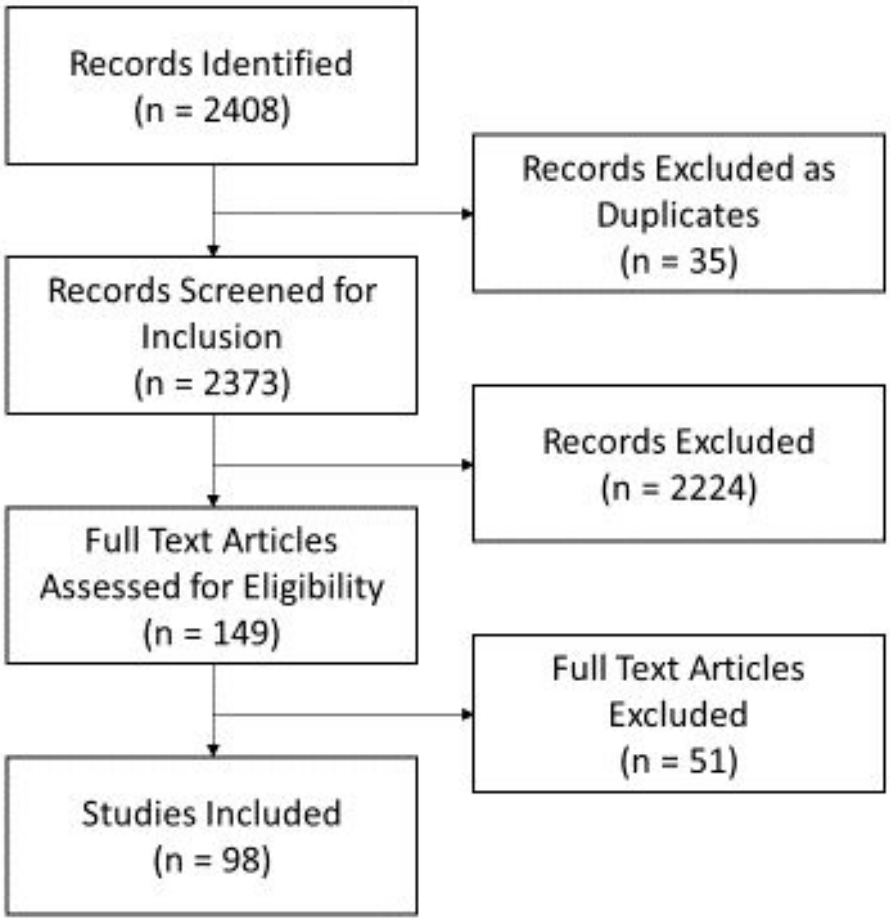

Figure 1 - PRISMA flow diagram for screened and included papers.

Database: Embase Classic+Embase <1947 to 2018 October 20>, Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Search Strategy:
---
1 Group Practice/ (16988)
2 (group practice* or group medical practice* or group model or group models).tw. (14652)
3 1 or 2 (26886)
4 physicians/ or allergists/ or anesthesiologists/ or cardiologists/ or dermatologists/ or endocrinologists/ or gastroenterologists/ or geriatricians/ or nephrologists/ or neurologists/ or oncologists/ or radiation oncologists/ or ophthalmologists/ or otolaryngologists/ or pediatricians/ or neonatologists/ or pulmonologists/ or radiologists/ or rheumatologists/ or surgeons/ or neurosurgeons/ or orthopedic surgeons/ (443392)
5 (allerg* or an?esthesiolog* or cardiolog* or clinician* or dermatolog* or endocrinolog* or gastroenterolog* or geriatrician* or gerontol* or gyn?ecolog* or h?ematolog* or nephrolog* or neurolog* or obstetric* or oncolog* or ophthalmolog* or otolaryngolog* or patholog* or p?ediatrician* or neonatolog* or physiatr* or pulmonolog* or orthop?ed* or radiolog* or rheumatolog* or surgeon* or neurosurgeon* or urolog* or general practitioner*).tw. (5716273)
6 general practitioners/ or physicians, family/ or physicians, primary care/ or Primary Health Care/ (224656)
7 (general practitioner* or family physician* or primary care physician*).tw. (170297)
8 physician*.ab. /freq=3 (121030)
9 or/4-8 (6177351)
10 3 and 9 (7625)
11 (group physician* or group surgeon*).tw. (683)
12 10 or 11 (8258)
13 income/ or exp pensions/ or remuneration/ or exp "salaries and fringe benefits"/ (144814)
14 prognosis/ or exp treatment outcome/ (3037613)
15 "Outcome Assessment (Health Care)"/ (306264)
16 personal satisfaction/ or job satisfaction/ (99372)
17 exp Patient Satisfaction/ (191942)
18 (satisfaction or patient reported outcome*).tw. (275754)
19 "Quality of Life"/ (522787)
20 "quality of health care"/ or quality assurance, health care/ (297926)
21 (income or salary).tw. (205853)
22 Life Style/ (134714)
23 life style.tw. (24521)
24 lifestyle.tw. (167173)
25 quality.mp. (2447101)
26 Stress, Psychological/ (166129)
27 Burnout, Professional/ (18655)
28 (burnout or stress).tw. (1383633)
29 perception of care.tw. (479)
30 models, organizational/ (62847)
31 organi?ation* model*.tw. (2367)
32 Physician-Patient Relations/ (177062)
33 (patient adj2 physician adj3 relation*).tw. (7804)
34 (revenue* or profit or profits).tw. (52523)
35 insurance, health, reimbursement/ or reimbursement mechanisms/ or reimbursement, incentive/ (73589)
36 or/13-35 (7492929)
37 12 and 36 (3422)
38 group practice*.ti,kw. or (group medical practice* or medical group practice*).tw,kw. (4213)
39 ("in data review" or in process or "pubmed not medline").st. (2785791)
40 38 and 39 (62)
41 37 or 40 (3481)

42 limit 41 to english language (3323)
43 42 use ppez (1607)
44 *group practice/ (11289)
45 (group practice* or group medical practice* or group model or group models).tw. (14652)
46 44 or 45 (22481)
47 *physician/ or *anesthesiologist/ or *cardiologist/ or *dermatologist/ or *emergency physician/ or *endocrinologist/ or *gastroenterologist/ or *general practitioner/ or *geriatrician/ or *gerontologist/ or *gynecologist/ or *hematologist/ or *hospital physician/ or *immunologist/ or *intensivist/ or *internist/ or *neonatologist/ or *nephrologist/ or *neurologist/ or *obstetrician/ or exp *oncologist/ or *ophthalmologist/ or *orthopedic specialist/ or *otolaryngologist/ or *pathologist/ or *pediatrician/ or *physiatrist/ or psychiatrist/ or *pulmonologist/ or exp *radiologist/ or *rheumatologist/ or exp *surgeon/ or *urologist/ (262673)
48 (allerg* or an?esthesiolog* or cardiolog* or clinician* or dermatolog* or endocrinolog* or gastroenterolog* or geriatrician* or gerontol* or gyn?ecolog* or h?ematolog* or nephrolog* or neurolog* or obstetric* or oncolog* or ophthalmolog* or otolaryngolog* or patholog* or p?ediatrician* or neonatolog* or physiatr* or pulmonolog* or orthop?ed* or radiolog* or rheumatolog* or surgeon* or neurosurgeon* or urolog* or general practitioner*).tw. (5716273)
49 (family physician* or primary care physician*).tw. (68204)
50 physician*.ab. (702496)
51 47 or 48 or 49 or 50 (6368299)
52 46 and 51 (6994)
53 (group physician* or group surgeon*).tw. (683)
54 52 or 53 (7627)
55 exp *"salary and fringe benefit"/ or *income/ (26491)
56 exp *treatment outcome/ (62134)
57 exp *"quality of life"/ (156501)
58 *health care quality/ (102682)
59 quality.tw. (1879375)
60 (income or salary).tw. (205853)
61 *lifestyle/ (32389)
62 (life style or lifestyle).tw. (189605)
63 *stress/ or *burnout/ (63482)
64 (burnout or stress).tw. (1383633)
65 "perception of care".tw. (479)
66 health care organization/ (123801)
67 organi?ation* model*.tw. (2367)
68 *doctor patient relation/ (68839)
69 (patient adj2 physician adj3 relation*).tw. (7804)
70 (revenue* or profit or profits).tw. (52523)
71 *reimbursement/ or *health insurance/ (81697)
72 *health care quality/ (102682)
73 *patient satisfaction/ (45768)
74 *satisfaction/ or *job satisfaction/ or *life satisfaction/ (37526)
75 satisfaction.tw. (253885)
76 patient reported outcome*.tw. (25479)
77 or/55-76 (4161152)
78 54 and 77 (2598)
79 limit 78 to english language (2485)
80 79 use emczd (1433)
81 conference abstract.pt. (2652420)
82 80 and 81 (152) Embase Conferences
83 80 not 82 (1281)
84 43 or 83 (2888)
85 remove duplicates from 84 (2105)
86 85 use ppez (1554) Medline
87 85 use emczd (551) Embase

Supplementary Appendix B

Table 1 - Papers Assessing Patient Outcomes

Author	Study Design	Population Studied	Key Findings
Sellers, 1965	Retrospective cohort study	Patients Physicians	More laboratory investigations and consultations for group practice patients and patients report more personal attention and in-depth explanations of a diagnosis and treatment by physicians in solo practices.
Graham, 1972	Review	Physicians	Limited evidence shows improvement in accessibility, continuity, quality, and efficiency with group practices. Potential drawbacks included dilution of the doctor-patient relationship and less autonomy.
Ritchey, 1975	Survey	Patients	Patients with solo GPs have better relationships with their physicians. Patients with GPs in group practice have greater unmet needs.
Roos, 1980	Retrospective Cohort study	Physicians	Quality of care and productivity were not found to be different for physicians in solo vs group practices in Manitoba.
Cohen et al., 1986	RCT	Patients Physicians Allied Health	Patients were randomized to a new group practice model and found no changes to patient satisfaction but there was a decrease in charges and utilization for patients as well as improved access to care, and decreased

			waiting times.
Kuyvenhoven et al., 1990	Survey	Patients Physicians	GPs in the Netherlands were surveyed and 20% of solo physicians stated that they never consulted their peers, while those working in a group practice did so regularly, which was found to help improve the level of attention paid to somatic complaints.
Gawande & Benroth, 1999	Survey	Patients Physicians	Patient satisfaction increased following the expansion of a group practice from 18 to 36 orthopedic surgeons in Indianapolis. This was felt to be due to decreased waiting times and increased time spent with a surgeon.
Campbell et al., 2001	Survey	Patients Physicians Healthcare Systems	Solo GP practices have shorter consultation lengths (15.2 min) vs group practices (17.8 min).
Lin et al., 2004	Survey	Patients	Patients perceive better overall quality of care in primary care group practices compared to solo practices with regards to equipment, facilities, reliability, responsiveness, assurance, and empathy.
Orrantia, 2005	Case Report	Patients Physicians	A family group practice that was established in Marathon, Ontario allowed for the maintenance of a stable number of physicians and also allowed for

			increased health care services offered to the community.
Ashworth & Armstrong, 2006	Survey	Patients Physicians	Group practices obtained significantly higher Quality and Outcomes Framework scores in the UK when compared to solo practices.
Breon, 2009	Case Report	Physicians Healthcare Systems	After the establishment of a surgical group practice in rural Iowa by five surgeons the access to surgical care at multiple hospitals improved and shared call coverage was achieved.
Gaal et al., 2010	Survey	Physicians	Larger primary care practices in Europe were found to have more patient safety features present, but clinical outcomes were not assessed in this paper.
Tourigny et al., 2010	Survey	Patients	Patient perception of continuity of care increased, accessibility remained the same, and physician co-ordination with specialists decreased in this before and after study following implementation of group practices in Quebec.
Weeks et al., 2010	Cross-sectional Study	Patients	Large multispecialty group practices enrolled with the Council of Accountable Physician Practices delivered better quality of care at a lower cost than other groups.
Rittenhouse	Survey	Patients	Larger groups used more patient-centered medical home processes than solo or

et al., 2011			2 physician groups.
Landon, 2012	Conference	Healthcare Systems	A primary care internist who moved from a small practice to a large group practice after many years found that the level of care he was providing was compromised by the large group and payers setting targets for the group.
van den Heuvel et al., 2012	Survey	Patients	From a survey of patients seen in a group practice hernia clinic, most were found to be satisfied with any surgeon from the group performing their surgery, even if they hadn't met them until the day of surgery, and felt that the group practice allowed for more efficient use of resources.
Damiani et al., 2013	Systematic Review	Patients Physicians Healthcare Systems	GP group practices had positive impacts on prescribing appropriateness compared to solo practices. Other quality measures were found to have insufficient evidence in the included papers.
Devlin et al., 2013	Survey	Patients Physicians	Larger family physician group practices were associated with better access to care, comprehensiveness, and disease prevention. Continuity of care was negatively affected.
Ly & Glied, 2013	Survey	Patients Physicians	Large primary care group practices (> 10 physicians) in the United States were found to have shorter waiting times by 14 minutes for patients.

Mehrotra et al., 2013	Cross-sectional Study	Patients	Patients in integrated medical groups received higher quality care based on 6 quality measures compared to independent practice associations. The self-reported use of electronic medical records was higher as well.
Perkins et al., 2013	Survey	Physicians	Obstetricians and Gynecologists in the United States are more likely to adhere to established cervical cancer prevention guidelines if they are part of a group practice, possibly because of improved knowledge sharing and access to information.
Pichetti et al., 2013	Survey	Physicians	In France, those who work in groups were more likely to prescribe multiple sourced rather than patented statins than solo practitioners.
Visca et al., 2013	Survey	Patients Physicians	No clinically significant difference was found between solo and group practices in the management of chronic diseases by GPs.
Wiley et al., 2015	Survey	Patients Physicians	Processes for the patient-centered medical home model have increased in all group practices sizes over time but are only present in less than half of even large groups. Additionally, a reduction in patient involvement in care was noted over time.
Fryer et al.,	Survey	Patients	The Patient Perceptions of Integrated Care survey identified a decrease in

2017			utilization of emergency department and outpatient resources amongst patient with multiple chronic illnesses who perceived a higher level of integration in the group practice that delivered care to them.
Baker et al., 2018	Survey	Patients Physicians	No significant changes reported in quality measures based on group practice size.
Bardos et al., 2018	Cohort	Patients Physicians	Compared to those in groups, solo obstetricians had a higher Cesarean section rates but lower rates of shoulder dystocia and third or fourth degree tears which was felt to indicate that they had a more conservative approach to labour.
Cohidon et al., 2018	Survey	Patients Physicians	Patients in family physician group practices in Switzerland reported a better experience with continuity and co-ordination of care compared to solo practices. No differences were seen in their experience with access and communication between the practice types.
Ellis et al., 2018	Systematic review	Patients Physicians	In a limited number of studies, patients appeared to be more satisfied with specialist group practices rather than solo practices with respect to tangibles and their own assessment of quality.

Freemyer & Stoff, 2018	Case Report	Patients Physicians	In a group practice, there may be differing opinions and risk tolerance amongst members especially with non-adherent patients and potentially dangerous medications. In order to minimize the effect on continuity of care, physicians in group practices should develop policies around challenging situations and apply these consistently to patients.
Hollenbeck et al., 2018	Cohort	Patients Physicians	Prostate cancer patients were found to be more likely treated with intensity-modulated radiation therapy if the urology group owned radiation facilities regardless of group size even if the treatment was unlikely to be beneficial, suggesting that the financial incentive outweighed best practices in prostate cancer care and that group practices do not prevent conflicts of interest.
Stol et al., 2018	Survey	Physicians	Practices that implemented selective prevention for cardiometabolic diseases were more often group practices rather than solo practices. These practices were also organized better for chronic disease management.
Xierali, 2018	Cross-sectional study	Physicians	Physicians in group practices were more likely to practice at multiple sites which may increase the access to care for patients.

Table 2 – Papers Assessing Physician Outcomes

Author	Study Design	Population Studied	Key Findings
Bailey, 1968	Cohort	Patients Physicians	Physicians, rather than patients, benefit the most from multidisciplinary group practices as their output was lower, fees were higher, and they ordered more tests especially if that service was offered by the group.
Rose, 1968	Letter	Physicians	Income deferral by physicians until later in life when they were less productive was viewed as a benefit of group practices.
Terris, 1968	Letter	Physicians	Group practices were mostly limited to hospitals with most other physicians working in solo practices outside of the hospitals, and it was believed that group practices would not be taken up unless it was established as a desirable form of practice to society and health care professionals.
Weinerman, 1968	Letter	Patients Physicians	Group practices needed to be refocused on patients in order to be relevant to societal needs.
Verbeek-Heida, 1969	Survey	Physicians	A significant desire for contacts and co-operation with other general practitioners led to improved attitudes about group practices in the Netherlands.

Mahoney, 1973	Survey	Physicians	Future surgeons preferred solo practice due to the potential loss of autonomy while future obstetricians and pediatricians preferred practice partnerships, and future internists preferred group practices.
Wallace, 1974	Letter	Physicians	This letter from the secretary-general of the Canadian Medical Association highlighted the possible need for government support to help with the establishment of medical groups.
Evashwick, 1976	Cross-sectional Study	Physicians	Non-metropolitan areas in the United States that have a greater percentage of group practices have better retention and recruitment rates.
Kimbell & Lorant, 1977	Survey	Physicians	In 1979 in the United States, physician annual gross revenue, total patient visits per year, and office visits per year were measured and there were increasing returns to scale for physicians in solo or small group practice and inefficiencies noted in large group practices.
Paulick & Roos, 1978	Survey	Physicians	In Canada, 57% of graduating physicians entered a group practice or partnership, 21% entered solo practice, and 22% became salaried physicians. Surgeons and psychiatrists were most likely to enter solo practice.

Davies, 1979	Survey	Physicians	In 1978 in New Zealand, group practices had higher cost than solo practices.
Graham, 1979	Survey	Physicians	The Manpower Survey of Oral Surgery was performed and it was reported that oral surgeons working in group practices had higher incomes and employed fewer full-time equivalent staff per surgeon.
Pasternak et al., 1986	Survey	Physicians	There was no significant difference in physician satisfaction between those practicing in groups vs those in solo practice in the southwest United States.
McCormick & Thomson, 1989	Survey	Physicians	GPs in solo practice earn less than those in group practices (gross income 19% less) due to lower fees and lower numbers of patients seen.
Holden, 1990	Letter	Physicians	Solo family physician practice in rural areas was in decline and unlikely to succeed as group practices were forming and offering better benefits to graduating residents.
Williams et al., 1990	Survey	Physicians	Half of the physicians were in either solo or group practices and the other half had some group practice arrangements for financial benefits. They hypothesized that future formation of group practices would require some incentives from government, which has happened.

Schryver et al., 1993	Case Report	Physicians	A unique group practice without walls structure is described which allows for the formation of a group with physicians at different locations. The members enjoy the business and professional benefits of a group practice, but this still allows for autonomy, decentralization, and individual practice style.
Hays & Sanderson, 1994	Interviews	Physicians	GPs in Australia who were interested in forming group practices were completed and identified incompatible personalities or practice styles, legal and real estate issues, and initial costs as barriers.
Connor et al., 1995	Survey	Physicians Healthcare Systems	Group practice opportunities are an important aspect in recruiting physicians to practice in a rural hospital in order to reduce isolation, pool resources, and decrease call burden.
Stamps, 1995	Survey	Physicians	Physicians in private group practices were significantly more satisfied with personal and lifestyle factors than those in solo, hospital, or health maintenance organization related practices.
Defelice & Bradford, 1997	Survey	Physicians	Data from the Physicians' Practice Cost and Income Survey found no significant differences in practice efficiency between solo and group primary care practices in the United States.

Hueston, 1998	Survey	Physicians	GPs associated with solo or small group (≤3 physicians) practices were found to be less satisfied.
Dowell et al., 2000	Survey	Physicians	GPs associated with solo practices were found to be less satisfied than those in group practices.
Bland et al., 2001	Cohort	Patients Physicians	Income pooling within an obstetrical call group in a Canadian study led to decreased rates of elective induction of labour in a before and after study.
Romano, 2001	Letter	Physicians	Group practices generally enhanced United States physicians' quality of life, improved patient care, improved professional development, and led to higher earnings.
Sturm, 2002a	Survey	Physicians	Data from the Community Tracking Study was used to show that surgeons working within a small practice was the greatest predictor of career dissatisfaction and that patient quality of care was impacted by income pressures as well as decreased continuity of care and clinical freedom within solo or 2 surgeon practices.
Sturm, 2002b	Survey	Physicians	Data from the Community Tracking Study found that physicians working within a solo or 2 physician practice was the greatest predictor of career

			dissatisfaction. They also reported less clinical freedom and constraints on income.
Casalino et al., 2003	Survey	Physicians Healthcare systems	Data from the Community Tracking Study was also used to find that the most frequently cited reason for group practice formation was negotiating leverage, and barriers included lack of leadership, physician co-operation, and investment.
Crane & Dennis, 2003	Case Report	Physicians Healthcare systems	The growth and subsequent deterioration of a large orthopedic group practice which amalgamated multiple smaller groups is described. The eventual demise of the practice appeared to be due to poor leadership, disagreements over re-imbursement, differing visions for the future of the group, dissatisfied office staff who were in danger of being let go due to centralization, difficulty in negotiations with payers, and being undercut by smaller competing groups.
Curoe et al., 2003	Survey	Physicians	Physicians in the United States found that as group practice size increases, the culture is less collegial, less cohesive, and there is less organizational trust which was also true for multi-specialty practices compared to single specialty.

Feron et al., 2003	Survey	Physicians	Physicians working in solo practices viewed improved quality of life, knowledge sharing, and continuity of care as motivation to form a group practice. Interpersonal relationships, budget issues, loss of the patient-physician relationship, and differing views of the group were viewed as barriers.
Casalino et al., 2004	Survey	Physicians Healthcare systems	Data from the Community Tracking Study was used to assess the reasons for growth of group practices and it was seen that physicians were increasingly forming single specialty group practices to not only increase the scope of surgical services and diagnostic imaging they could offer, but also gain negotiating leverage with payers.
Lin et al., 2006	Survey	Physicians	In Taiwan, higher incomes were realized by physicians who were in single or multi-specialty groups when compared to solo practice physicians.
Solberg et al., 2006	Survey	Physicians	Within a family medicine group in the United States, categories important to a high level of care included teamwork, leadership, patient centered care, quality improvement, accountability, and a sense of ownership.
Liebhaber &	Letter	Physicians	From 1996/97 to 2004/05, the proportion of physicians in solo or 2 physician

Grossman, 2007			practices decreased from 40.7% to 32.5% and physicians were increasingly forming single specialty rather than multi-specialty group practices.
Lowes, 2007	Survey	Physicians	Primary care physicians in the United States were earning more money if they practiced within groups of more than 50 physicians.
Rivet et al., 2007	Survey	Physicians	Family physicians in solo practice had greater overall job satisfaction in this survey that primarily assessed improved satisfaction associated with performing procedures.
Zazzali, Alexander, Shortell, & Burns, 2007	Survey	Physicians	Stronger group culture emphasizing participation, teamwork, and cohesiveness promoted physician satisfaction. Conversely, a hierarchical structure had a negative effect on satisfaction.
Masselink, Lee, & Konrad, 2008	Survey	Physicians	Data from the Physician Worklife Survey found that good relationships with colleagues in a large group practice led to a decrease in a physician's intent to withdrawal from practice. A similar effect was not seen for physicians in small or solo practices.
Breon, 2009	Case Report	Physicians	After the establishment of a surgical group practice in rural Iowa by five

		Healthcare Systems	surgeons the access to surgical care at multiple hospitals improved and shared call coverage was achieved.
Rodríguez & Pozzebon, 2010	Case Study	Physicians Allied health Healthcare systems	A family medicine group in Quebec was assessed during its formation and difficulties with interpersonal and interprofessional relationships were identified and found to be quite detrimental to the functioning of the team. A new director was able to mend these relationships, improve communication, and move the group forward.
Streu et al., 2010	Survey	Physicians	Working within a group practice led to increased job satisfaction for plastic surgeons as they were less professionally isolated.
Koppula et al., 2011	Interviews	Physicians	Group practices allowed family physicians to have a better work-life balance, collaboration, and support from fellow group members and allowed for continuity of care during and beyond the obstetrical events. Some challenges identified included sustainability (securing locum physicians to cover absences) and conflict within the group.
Rao et al., 2011	Survey	Physicians	Family physicians in the United States in solo practices were found to be less likely to adopt electronic health records when compared to those in group

			practices.
Suchman A et al., 2011	Abstract	Physicians	Chronic conflict, behavioural accountability, and a common vision were addressed in a small group practice through regular meetings, retreats, and an objective assessment by allied health professionals to improve group function.
Orton et al., 2012	Survey	Physicians	Higher rates of depersonalization were identified in GPs in the UK working in group practices vs solo practices which was felt to be due to poor interpersonal relationships as well as increased demands and less autonomy.
Burns et al., 2013	Review	Physicians	Currently, part of the reason larger groups in the United States may be forming is because they are able to leverage insurers more effectively and build up more market share. Groups with over 100 physicians are increasing.
Damiani et al., 2013	Systematic Review	Patients Physicians Healthcare Systems	Greater uptake of health information technology in GP group practices compared to solo practices and a higher satisfaction with compensation was noted.
Mosaly et al., 2013	Abstract	Physicians	Physicians who cross-cover patients may perceive that their workloads are increased, and performance decreased.

Welch et al., 2013	Cross-sectional Study	Physicians	Between 2009 and 2011, groups of greater than 100 physicians continued to increase in number, with a decrease in the number of solo practitioners.
Xierali et al., 2013	Survey	Physicians	Family physicians in solo or small practices were less likely to adopt electronic health records compared to those in larger group practices.
Heimeshoff et al., 2014	Survey	Physicians	Technical efficiencies were higher for group practices, but this was also associated with higher costs compared to solo practices.
Robinson & Miller, 2014	Cross-sectional Study	Physicians	Hospital owned physician groups had higher costs than physician owned groups in California between 2009 and 2012.
Schulte et al., 2014	Survey	Physicians	Family physicians were less likely to pass the American Board of Family Medicine maintenance of certificate exam if they were in a solo practice which was thought to result from the ability to spend more time on quality improvement and education within a group practice (OR 0.48 [95%CI 0.34 – 0.68]).
Streu et al.,	Survey	Physicians	Working in a group practice was identified as a practice characteristic

2014			associated with professional burnout in plastic surgeons and comments from the survey seemed to indicate that this was due to poor interpersonal relationships within groups.
Valentine et al., 2014	Survey	Physicians	Surgeons working in solo practice were less likely to pass their maintenance of certification examination compared to those in group practices (OR 0.22 [95% CI 0.06-0.77]).
Kralewski et al., 2015	Survey	Physicians	Group practices that focus on improved screening and monitoring may improve avoidable utilization, cost, and revenue.
Moosa et al., 2016	Survey	Physicians	GPs working in groups were more optimistic about the future compared to solo practitioners and worked fewer days but saw more patients per day.
Muhlestein & Smith, 2016	Cross-sectional Study	Physicians	Between 2013 and 2015, the largest changes in group practice size were a decrease in small groups and an increase in very large groups of over 100 physicians. Groups of 100 or more increased from 29.6% to 35.1%. Groups with 1-2 physicians decreased from 22.5% to 19.8%.
Fryer et al., 2017	Survey	Patients	Improved utilization of emergency department and outpatient resources amongst patients with chronic illnesses in group practices who perceive a

			higher level of integration.
Gisler, Bachofner, Moser-Bucher, Scherz, & Streit, 2017	Survey	Physicians	Young GPs in Switzerland prefer to work part-time in group practices of up to 5 physicians.
Kwietniewski et al., 2017	Survey	Physicians	Costs of group practices were higher than those of solo practices due to more investment in technological costs that solo practices would not be able to afford.
Mazurenko et al., 2017	Survey	Physicians	Solo physicians had less health information technology and had less email correspondence with patients and other physicians.
Viehmann et al., 2017	Survey	Physicians	Chronic stress was identified in 26.3% of German GPs and practice assistants with no difference observed between those in solo and group practices.
Baker et al., 2018	Survey	Patients Physicians	The use of HIT, care management processes, and quality improvement processes increased over time, but only quality improvement processes were

			attributable to a larger group size. Additionally, no significant differences were seen in cost and quality between different group sizes.
Kwietniewski & Schreyögg, 2018	Survey	Physicians	Group practices of all sizes and most specialties have been shown to have more technical, cost, and profit efficiencies than solo practices and this was thought to be due to the standardization of processes.
Noroxe et al., 2018	Survey	Physicians	More than half of Danish GPs reported at least one burnout symptom. Those in group practices were less likely to report a poor work-life balance compared to solo GPs.

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	4-5
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	5
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	6
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	6
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Supp App B
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	6-7
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	7
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	7

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	8 Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	8 Supp App A
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	8-14 Supp App A
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	8-14
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	15-17
Limitations	20	Discuss the limitations of the scoping review process.	18
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	18-19
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	19

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

BMJ Open

Group Practice Impacts on Patients, Physicians, and Healthcare Systems: A Scoping Review

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-041579.R1
Article Type:	Original research
Date Submitted by the Author:	18-Nov-2020
Complete List of Authors:	Zwiep, Terry; Western University, Surgery Ahn, San (Hilalion); The Ottawa Hospital, Surgery Brehaut, Jamie; Ottawa Hospital Research Institute, Clinical Epidemiology Program Balaa, Fady; The Ottawa Hospital McIsaac, Daniel; The Ottawa Hospital, Anesthesiology and Pain Medicine Rich, Susan; The Ottawa Hospital Wallace, Tom; The Ottawa Hospital, Surgery Moloo, Husein; The Ottawa Hospital, Surgical Oncology; The Ottawa Hospital Research Institute , Clinical Epidemiology Program
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Medical management, Health policy
Keywords:	HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisation of health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Group Practice Impacts on Patients, Physicians, and Healthcare Systems: A Scoping Review

Terry M Zwiep, Western University, London, Ontario, Canada
San (Hilalion) Ahn, The Ottawa Hospital, Ottawa, Ontario, Canada
Jamie Brehaut, Ottawa Hospital Research Institute, Ottawa, Ontario, Canada
Fady Balaa, The Ottawa Hospital, Ottawa, Ontario, Canada
Daniel I McIsaac, The Ottawa Hospital, Ottawa, Ontario, Canada
Susan Rich, The Ottawa Hospital, Ottawa, Ontario, Canada
Tom Wallace, The Ottawa Hospital, Ottawa, Ontario, Canada
Husein Moloo, The Ottawa Hospital, Ottawa, Ontario, Canada

Corresponding Author: Terry Zwiep
Western University
E2-211, 800 Commissioners Rd. E.
London, ON, N6A 5W9
Phone: (519) 685-8260
Fax: (519) 685-8378
terry.zwiep@lhsc.on.ca

ABSTRACT

Objective: To identify the advantages and disadvantages that group practices have on patients, physicians, and healthcare systems.

Study design: A scoping review was performed based on the methodology proposed by Arksey and O'Malley, and refined by Levac and colleagues. Titles and abstracts were screened by two reviewers. A quantitative analysis was performed to assess the type, year, and region of publication as well as the population studied. A qualitative descriptive analysis was performed to identify common themes.

Study setting: MEDLINE, EMBASE, and Cochrane databases were searched for papers which assessed outcomes relevant to the research question.

Results: Our search strategy returned 2408 papers and 98 were included in the final analysis. Most papers were from the United States, were surveys, and assessed physician outcomes. Advantages of group practices for patients included improved satisfaction and quality of care. Studies of physicians reported improved quality of life and income, while disadvantages included increased stress due to poor interpersonal relationships. Studies of healthcare systems reported improved efficiency and better utilization of resources.

Conclusions: Group practices have many benefits for patients and physicians. However, further work needs to be done assessing patient outcomes and establishing the elements that make a group practice successful.

Strengths and limitations of this study:

- This was a large, comprehensive overview of group practices from many countries
- The scoping review methodology allowed us to assess a wide variety of papers and identify key gaps in the knowledge for further study
- Patient engagement was instrumental on focusing this review on patient outcomes and areas for improvement
- This review was limited by language restrictions, heterogeneity of the data, and possible publication bias

INTRODUCTION

Group practices have existed for over 100 years with one of the first groups set up by the Mayo brothers in the mid-1880s[1]. This group was eventually transformed into a large organization that has been recognized as a center of excellence leading to benefits for patients and physicians. Following their success, group practices became more and more common, and currently, many physicians around world are practicing within groups or partnerships[2–5]. Sizes of group practices vary dramatically, from 2 physicians to over 100 physicians, and there is no standard definition of what defines a group. Over the years many papers have been published on group practice formation assessing various advantages and disadvantages for patients, physicians, and healthcare systems as well as the impetus behind their development. The economic benefits of these groups and the improvements in service provision to patients is supported by the literature and has been well documented[3,6–8]. Barriers to the formation of group practices, or conflicts that can result from group practices have also been considered and often have to do with interpersonal relationships[9–12]. The extent of literature spans many decades and provides an excellent overview of how group practices have evolved and the effects which they have had on patients, physicians, and healthcare systems.

Patient care can be significantly altered by the formation of group practices, and it is important to consider this impact as groups are often formed for reasons that are not directly related to patient care[11,13–15]. Some of these other reasons include the benefits realized by physicians with regards to income, quality of life, satisfaction, and decreased physician burnout, which is estimated to affect more than half of physicians [9,16–19]. Group practices also may be developed due to healthcare system incentives, or as a way to improve the income and efficiency of physicians within a given system[14,20–23]. This again may not be directly related to patient care

but may have impacts on the quality of care and its timeliness. Whatever the motivation for forming group practices, it is important to assess the effects on all involved stakeholders to ensure that this is a step in the right direction for the patients that we are committed to serve, the wellbeing of physicians, and the sustainability of the systems which we work within.

There has been a paucity of literature that synthesizes the knowledge published regarding group practices. A systematic review published in 2013 assessed the effectiveness of group versus solo practice amongst general practitioners (GPs) and demonstrated a positive association between group practices and clinical processes, physicians opinions, and innovation, but did not observe any effect for patient measures[7]. A recent review has also attempted to establish a definition for group practices and the overall shift towards their development[24]. The objectives of this study were to review the literature for evidence that assesses the advantages and disadvantages that group practices have on patients with regards to quality of care and satisfaction; physicians with regards to team dynamics, income, and satisfaction; and the financial impact on healthcare systems. A scoping review was performed as we expected to identify heterogenous studies with a wide range of outcomes focused on patients, physicians, and healthcare systems. A broad overview of the literature was desired to identify current knowledge gaps and guide further studies.

METHODOLOGY

A scoping review was performed according to the methodology proposed by Arksey and O'Malley, and refined by Levac and colleagues[25,26]. The PRISMA extension for scoping reviews (PRISMA-ScR) checklist was used to ensure all relevant aspects of a scoping review were included[27]. The following research question was developed:

What advantages and disadvantages do group practices have for patients, physicians, and healthcare systems?

A complete scoping review protocol was developed and published[28]. The following stages were incorporated into this scoping review according to what is suggested by Levac et al.: identifying the research question; identifying relevant studies; study selection; charting the data; collating, summarizing, and reporting results; and consultation. Full details on each stage can be found in the published protocol[28]. Briefly, MEDLINE, EMBASE and Cochrane Central were searched from database inception to October 2018 to identify relevant studies that assess the impact of group practices on patient care, satisfaction, and outcomes; physician quality of life, satisfaction, and income; and healthcare system finances. There were no restrictions placed on publication date. The grey literature was not searched as originally indicated in the protocol due to an adequate number of peer-reviewed articles which met inclusion criteria from the databases. The search strategy was peer reviewed according to the formal process outlined by McGowan et al[29]. The search strategy is included in Appendix A.

Three members of the research team met to perform a calibration exercise and review 10 papers to pilot the screening and full text data extraction forms. Titles and abstracts were subsequently screened independently by two reviewers and the abstraction results from the full text articles were charted and verified by the same two members. Disagreements were resolved by discussion between the two reviewers as well as input from other authors of the paper. We included papers that:

- Included patients receiving, and/or clinicians providing care within any type of group practice (Population)

- Assessed the advantages and/or disadvantages of group practices (Concept)

We examined all papers from group practices in all areas of medicine which reported outcomes relevant to patients, clinicians, or health system stakeholders (Context).

Papers were excluded if they were not published in the English language.

DistillerSR (Evidence Partners, Ottawa, Canada) was used for screening and data extraction. A standardized form was created and tested on 10 papers by three members of the research team. We did not deviate from the protocol and charted authors, year of publication, country of origin, objectives, type and size of group practice, population studied (patients, physicians, etc.), sample size, methods and type of study, interventions, outcomes, and key findings[28]. This standardized form was used throughout the study and no changes were required after it was tested.We extracted and summarized included paper characteristics including type of study, year, region of publication, and the population studied. A qualitative analysis was also performed using a qualitative descriptive approach from the key findings of the selected papers[30]. A coding manual was created and codes were applied to the key findings. These were refined as the study progressed and grouped into themes. This was performed in parallel by two reviewers who then met to discuss the results and corresponding themes. After a conventional content analysis, common themes were grouped by:

1) patient care, including satisfaction and quality of care

2) physicians, including quality of life, competency, group dynamics, group characteristics, and financial impacts

3) healthcare system issues relating to financial impacts

A detailed quality assessment was not performed due to the heterogeneity of the data and the general principles of a scoping review[26]. During the scoping review process, we consulted with four surgeons from other group practices to ensure that the review was comprehensive and

that all relevant papers were included. These surgeons were known by the research group to be participants in group practices.

Patient and Public Involvement

A patient advisor was recruited from the Department of Patient Relations as part of the research team. As practice organization directly impacts on patients, it was essential that we had patient input into the design of the study and the analysis of the data. The patient advisor collaborated with the team and ensured that the research question and outcomes were applicable to patients and reviewed the final draft of the paper[31].

RESULTS

Using the search strategy outlined in Supplementary Appendix A, 2408 papers were identified. Of these, 35 were excluded as duplicates and 2373 titles and abstracts were screened. After screening, 149 full text articles were examined and 98 met inclusion criteria. Of those excluded, 34 did not assess advantages or disadvantages of group practices, 5 papers focused on multidisciplinary groups, 2 papers were based on a previous paper and did not provide any new data, and 1 paper assessed a dental group practice. We were unable to obtain full text articles for 9 papers. The PRISMA flow diagram in Figure 1 displays these results.

The majority of papers were from the United States (58%), followed by Europe (19%), and then Canada (15%). There were only a handful of papers from elsewhere in the world (7%). Papers frequently included more than one type of group practice. Family medicine was reported on most commonly (76%), followed by surgical practices (43%), and all others (36%). Physicians (94%) were the focus of almost all the papers rather than patients (26%), allied health (4%), or healthcare systems (10%). Some papers touched on multiple populations. Most of the

included papers were surveys (63%). Group practices have been published on dating back until at least the 1960s. Recurring themes were evident over the years and are expanded on in the qualitative analysis. See Table 1 for a full description of included papers.

Table 1 - Selected Paper Characteristics

Characteristic		n (%)
Region of Study	United States	56 (57%)
	Europe	20 (20%)
	Canada	16 (16%)
	Other	7 (7%)
Type of Group Practice	Family Medicine or General Practitioner	74 (76%)
	Surgical	42 (43%)
	Other	35 (36%)
Population Studied	Physicians	92 (94%)
	Patients	25 (26%)
	Healthcare Systems	10 (10%)
	Allied Health	4 (4%)

Type of Publication	Survey	62 (63%)
	Letter	7 (7%)
	Case Report	6 (6%)
	Cohort Study	5 (5%)
	Abstract	2 (2%)
	Case Series	2 (2%)
	RCT	2 (2%)
	Systematic Review	2 (2%)
	Other	10 (10%)
Publications by Decade	1960-1969	6 (6%)
	1970-1979	9 (9%)
	1980-1989	5 (5%)
	1990-1999	9 (9%)
	2000-2009	23 (23%)
	2010-present	46 (49%)

Group Practices Improve Patient Satisfaction and Experience

Sources that addressed patient outcomes are listed in Supplementary Appendix B. Six of these provided evidence that group practices can result in improvements in patient satisfaction[23,32–35]. Four of these sources were surveys that assessed changes in satisfaction after the implementation or expansion of a group practice. This sense of satisfaction appeared to be most commonly due to better perceived access to care and quality of care. In contrast to this, one survey from 1975 identified a negative effect on patient satisfaction and experience[36]. The Patient Perceptions of Integrated Care survey identified that patients with multiple chronic diseases who perceive a higher level of integration within a group will utilize less emergency department and outpatient resources[37].

Patient Quality of Care

The aspects of quality of care assessed by the papers included access to care, continuity of care, prescribing techniques, adherence of the physicians with established clinical guidelines, frequency of consultations, and unnecessary investigations and treatment. Twenty-two sources either identified an improvement in patient quality of care associated with group practices or a negative impact on patient quality of care. Two sources did not identify any differences in patient quality of care based on practice organization[38,39].

Group Practices Improve Patient Quality of Care

Twenty-two sources demonstrated improvements in patient quality of care. This included objective measures with quality of care scores as well as patient perception as captured by surveys. Group practices were found to improve access to care, comprehensiveness, waiting times, time spent with patients, efficiency, patient safety, and utilization of resources according to patient reported outcomes[6,8,33,40–48]. Patients perceived a higher quality of care with group

practices with regards to tangibles (equipment and facilities), reliability, responsiveness, assurance, and empathy[49]. Physicians in group practices had higher quality of care scores and adherence to guidelines was found to be better due to increased knowledge sharing and access to information[35,44,50,51]. Improvements in appropriate prescribing techniques were also associated with physicians working in group practices[7,52]. Physicians in group practices were also more likely to consult peers[53]. More patient-centered medical home processes within a practice were associated with larger groups compared to solo and small group practices (1-2 physicians), although all types of practices have shown modest increases over time[54,55]. However, a recent paper based on large surveys found no improvements in quality measures based on practice size[56].

Group Practices Negatively Impact Patient Quality of Care

Six sources noted some negative impacts with group practices on patient quality of care. This included worse continuity of care and dilution of the patient-doctor relationship[41,57]. Group practices have also been found to order more investigations or treat inappropriately if there was a financial benefit[8,58,59]. Additionally, a primary care internist who moved from a small practice to a large group practice after many years perceived that the level of care he was providing was compromised by the large group and payers setting targets for the group[60].

Physician Quality of Life, Satisfaction, and Burnout

Papers which assessed physician outcomes are listed in Supplementary Appendix B. Twenty papers assessed the relationship between group practices and physician quality of life, satisfaction, and burnout. Two papers did not find any significant difference in this area for group and solo practices[61,62]. Two main themes were identified from the sources including the

following: group practices improve physician quality of life and satisfaction, and group practices lead to conflict and additional stress for physicians.

Group Practices Improve Physician Quality of Life and Satisfaction

Group practices were often found to improve the work-life balance and job satisfaction of physicians when compared to solo practices[9,19,63–67]. Being a member of a group practice led to less professional isolation, improved knowledge sharing, and an improvement in professional development[9,19,68]. Improved attitudes about group practices in the Netherlands were related to an increased desire for contact and cooperation with other physicians[69]. Satisfaction with personal and lifestyle factors and optimism for the future was increased amongst physicians in group practices[70,71]. Group practices were also associated with a decreased call burden and increased cross coverage of patients which directly impacts the quality of life for most physicians and their families[6,68]. Due to the aforementioned benefits, group practices have also been noted to improve retention and recruitment initiatives, especially in rural or underserviced areas[68,72].

Group Practices Lead to Conflict and Additional Stress for Physicians

Seven sources have identified issues with group practices that create conflict and additional stress for physicians. These center around the interpersonal relationships of the group members and sustainability[63]. Poor interpersonal relationships lead to lower job satisfaction and a higher degree of professional burnout[73,74]. Three papers identified that group practices were also associated with increased physician demands, decreased performance, and reduced autonomy[74–76]. A large survey of family physicians in Canada found that physicians in solo practice had more job satisfaction than those in group practices in a survey that was primarily assessing improved satisfaction with performing procedures[77].

Group Practices Improve Physician Competency

Two papers addressed differences in physician competency[78,79]. Family physicians and surgeons were found to be less likely to pass their respective maintenance of certification exams if they were in a solo practice. This was thought to result from the ability to spend more time on quality improvement and education within a group practice.

Facilitators and Barriers Associated with Working in a Group Practice

An important theme that arose during analysis was the identification of barriers and facilitators associated with forming or maintaining a group practice. These characteristics have direct impacts on patient care and physician quality of life, job satisfaction, and burnout. Eight sources identified these characteristics and they are summarized in Table 2[10,12,22,80–84].

Table 2 - List of Barriers and Facilitators for Group Practices

Facilitators	Barriers
Teamwork[81,82]	Incompatible personalities[10,22]
Leadership[22,81]	Poor leadership[12]
Common vision[84]	Different visions for the group[12]
Patient centred care[81]	Disagreements about re-imbursement[12]
Quality improvement[81]	Legal and real estate issues[10]
Accountability[81]	Dissatisfied office staff[12]
Sense of ownership[81]	Fears about loss of autonomy[80]
Sense of responsibility[82]	
Cohesiveness[82,83]	

Group Practices Lead to Higher Incomes for Physicians

Seven sources from the United States, Taiwan, and South Africa have identified increased individual earnings for physicians practicing within group practices[15,21,71,85–88]. Physicians in group practices have also been shown to be more satisfied with their compensation. A letter published in 1968 highlighted income deferral by physicians until later in life when they were less productive as an additional benefit of group practices[89]. Currently, larger groups may be forming in the United States as they are able to leverage insurers more effectively and build up more market share[3].

Costs of Group Practices are Higher than Solo Practices

Costs of group practices have been found to be higher than those of solo practices[20,90,91]. This may be due to more investment in technological costs that solo practices would not be able to afford[20,91]. Some large group practices may also be more inefficient than solo or small group practices[92].

Group Practices May Improve the Uptake of Health Information Technology

Physicians practicing in groups are more likely to have greater access to health information technology (HIT) and were also more likely to correspond with their patients and other providers via email[7,93]. Family physicians in the United States in solo practices were found to be less likely to adopt electronic health records when compared to those in group practices[94,95]. Data from two large surveys indicated a general trend towards increased use of HIT over time, but did not see a clear association between group size and an increased use of HIT[56].

More Physicians are Practicing in Group Practices and Group Practices are Increasing in Size

Many sources have tracked the rise in the number and type of group practices over the years (Supplementary Appendix B). The definition of a group practice is very heterogenous in

the literature and previous work has been done in an attempt to classify groups[24]. Often, groups of 1-19 physicians are classified as small or medium (further subclassified into groups of 1-2, 3-7, 8-12, and 13-19), and groups of 20 or more are classified as large (further subclassified into groups of 20-99 and >100).[54,55] The included papers show an increase in the absolute number of group practices and their sizes over the years.

In 1968, group practices were mostly limited to hospitals with most other physicians working in solo practices outside of the hospitals, and it was believed that group practices would not be taken up unless it was established as a desirable form of practice to society and health care professionals[96,97]. Now, in the United States, more physicians across all specialties are forming or joining larger groups and groups of more than 100 physicians which usually have non-physician owners, have grown rapidly in recent years[2–4]. This increase has been driven by the benefits group practices can offer physicians[11,13,98–101].

Despite having a very different healthcare system, group practices have also grown in Canada. In 1970, 57% of graduating physicians entered a group practice or partnership, 21% entered solo practice, and 22% became salaried physicians. Surgeons and psychiatrists were most likely to enter solo practice[5]. A survey of Canadian physicians in 1987 found that around half of the physicians were in either solo or group practices and the other half had some group practice arrangements for financial benefits[14]. Government support was seen as a key factor in establishing group practices[14,102].

Group Practices May Help Reduce Costs Within Healthcare Systems

Group practices have the potential to impact healthcare systems financially, with respect to access to care, and appropriate utilization of healthcare resources. Sources have shown that group practices of all sizes and most specialties have been shown to have more technical, cost,

and profit efficiencies than solo practices (Supplementary Appendix B)[103,104]. This is thought to be due to the standardization of processes[104]. Group practices that focus on improved screening and monitoring may improve avoidable utilization, cost, and revenue[103]. A higher level of integration perceived by patients with chronic illnesses also reduces utilization of emergency department and outpatient resources[37]. Income pooling within an obstetrical call group in a Canadian study led to decreased rates of elective induction of labour in a before and after study[105]. Older data from the Physicians' Practice Cost and Income Survey in 1986 found no significant differences in practice efficiency between solo and group primary care practices in the United States[106]. Additionally, a recent paper which included data from large surveys found that group size was not associated with an improvement in spending or quality[56].

DISCUSSION

We were able to identify themes associated with the advantages and disadvantages that group practices have for patients, physicians, and healthcare systems. It is important to note that the term 'group practice' refers to a broad range of practice types within the literature and there is no clear definition with respect to the critical pieces that define what a group practice is beyond the number of physicians and inclusion of one or more specialties. Organizations in the United States such as the America's Physician Groups, and American Medical Group Association have been developed to represent physicians in various types of groups. Groups may be defined as single specialty with two or more physicians or multispecialty with any number of different specialties providing care to patients.

Themes involving patients included satisfaction and quality of care. Generally, patients seemed to be more satisfied with care that was being received from physicians in group

practices[23,32,33,40]. From these studies, this appears to be due to increased access to care and decreased waiting times. Although continuity of care would seem to be a legitimate concern with a group practice as patients may be seeing different physicians on any given day, this was actually shown to be improved in one study[23]. Concerns surrounding continuity of care were raised in one study which addressed non-adherent patients in a group practice[57]. Furthermore, in a situation that is unique to a surgical group practice, patients did not seem to be concerned by the fact that they might not meet the surgeon who is operating on them until the day of their operation as they had confidence in any of the surgeons associated with the group[33].

While it is important that patients are satisfied with the care they are receiving, it is imperative that they also receive high quality care. Overall, most papers indicated that the quality of care increased with a group practice structure as measured objectively and subjectively. Adherence to guidelines and appropriate prescribing was better with group practices and quality of care scores improved[7,51,52]. There were some notable exceptions including using radiation therapy for prostate cancer when it was not necessarily indicated because the group owned radiation facilities, and the increased use of laboratory investigations offered by the group[15,58,59]. This may have been driven by convenience as well as financial gain.

Overall, patients appear to benefit from group practices through improved quality of care, access, and satisfaction. The data surrounding the impact of group practices on patients was presented in 24% of papers. This has been identified as an area for further research as we know that group practices are often formed to primarily benefit the physicians working within them[6,68,72].

Numerous advantages of group practices for physicians have been identified from this scoping review. They include increased quality of life and satisfaction, decreased burnout, higher

competency, and financial gain. More attention has been paid to physician burnout in recent years as the prevalence is surprisingly high[17,18]. Improving the quality of life and job satisfaction for physicians may help with this and group practices have the potential to help in these areas. Overall, most of the literature included in this review shows a positive association with group practices and physician quality of life and job satisfaction. These improvements result from a better work-life balance, shared call responsibilities, improved knowledge transfer, collaboration, and decreased professional isolation[6,9,63,66]. Physicians in solo practices may still be able to pursue similar opportunities but may face logistical challenges due to isolation.

A notable area of decreased satisfaction results from poor interpersonal relationships[12,22]. This can lead to the collapse of a group and highlights the need for group practice members to be compatible and share a common vision, especially if they are financially integrated. As groups become larger and larger, especially in the United States where groups of more than 100 physicians are not uncommon, relationships can become less collegial and autonomy may be lost[80]. The importance of regular meetings with a shared sense of ownership and responsibility has been shown to be very important to group function and quality of care[81,84]. Therefore, although groups have the potential to improve job satisfaction and quality of life for physicians, it depends on the overall functioning of the group and compatible personalities within the group for this to be achieved.

In the two papers assessing the level of physician competency (based on whether or not physicians were members of group practices) the overall impact seems to be positive with improved scores on certification exams[78,79]. This is thought to be due to more knowledge transfer between group members and less professional isolation. The ability to approach and consult

colleagues relatively easily about difficult or interesting clinical questions has the potential to enhance the learning of all group members and improve patient care.

Financially, group practices have been shown to improve incomes of physicians. This is most relevant in the United States where groups are often formed to gain negotiating leverage with payers[11,13]. However, individual incomes also seem to be higher in other areas of the world such as New Zealand, South Africa, and Taiwan[71,86,87]. The increased income may help offset costs associated with investments in equipment or technology that would not be feasible for solo physicians.

The impact of group practices on healthcare systems can be seen in improvements in access to care, system efficiencies, improved use of resources, and adherence to guidelines. Some exceptions to this may include inappropriate use of resources if there is a financial gain. Moving forward, this will be an important area of study as there are many different health care systems in place around the world.

This scoping review has allowed us to identify gaps in the literature which can be addressed in the future. As demonstrated above, patient care is often not the focus of research into group practices. This needs to be addressed to ensure that we are improving the service that is being delivered to the end user, namely, the patient. Creating a shared or group practice is often beneficial to physicians, but if the patient experience or quality of care is negatively impacted, this needs to be understood. Additionally, it was difficult to separate different types of group practices in the literature. The definition of a group practice varies significantly and includes anywhere from 2 to >100 physicians and/or allied health care providers[24]. This makes comparisons difficult. However, this scoping review has allowed us to perform a high level overview of all types of group practices and in an attempt to identify all characteristics which are

important to patients and physicians. The knowledge gaps we identified with respect to this issue includes a group practice definition and which elements contribute to a successful practice which benefits patients and physicians.

As part of the scoping review process, key stakeholders were consulted regarding this review. They included a patient advisor and members of other group practices. The patient advisor was included in the design of this study, verified the results, and reviewed the final draft of this manuscript. Other group practice members verified the results by reviewing the themes and included references, ensuring that all relevant papers were included. The patient advisor and group practice members will help to guide further research in the future. Some of the authors of this paper are group practice members and will be using their practice for research that will focus on patient outcomes including quality of care and satisfaction, as well as physician outcomes including quality of life, satisfaction, and burnout with guidance from this scoping review.

There are inherent limitations with a scoping review. This was meant to be a broad overview of the available literature and as such, the data are heterogenous and does not lend itself well to a quality assessment. There may very well be a publication bias with this topic as authors may only be inclined to publish on group practices that have worked very well. We were unable to obtain the full text for 9 papers. The included papers were also from many different regions and therefore, the conclusions may not be applicable to a particular country or region, however the objective of this review was to assess the advantages and disadvantages of group practices and common themes were identified that likely transcend many regional differences.

CONCLUSION

A group practice structure has many advantages for patients and physicians alike. Although the data is somewhat limited for patients compared to physicians, this scoping review

has shown that there is a generally positive patient experience with some evidence of improved quality of care. There is also an increase in physician satisfaction and quality of life in groups that function well with compatible personalities. This scoping review has summarized the available literature based on our research question and has allowed us to identify two interesting areas of future investigation. First, it will be important to define exactly what the critical elements of a group practice are beyond the number of physicians as there is no standard definition that we were able to discern in this scoping review. This may then be used to guide the development of functional groups that are able to improve care and quality of life for both patients and providers. Second, although most of the available literature is directed towards the impact of group practices on physicians, addressing patient outcomes and perspectives is essential. This has been addressed in the literature more recently, and is an area which should be further developed.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

ACKNOWLEDGEMENTS

We would like to acknowledge Risa Shorr and Josée Skuce for their help in developing the search strategy and obtaining full texts articles for this scoping review.

DATA AVAILABILITY STATEMENT

All data used are included in the article and supplementary appendices.

CONTRIBUTORS

HM, TZ, DM, and FB conceived the study. TZ and HM drafted the protocol and developed the research question. TZ and SA performed the title and abstract screening and full text data extraction. TZ, HM, JB, TW, and SR contributed to the thematic analysis and interpretation of the data. All authors read and approved the final manuscript. HM is the guarantor.

FIGURE LEGEND

Figure 1 - PRISMA flow diagram for screened and included papers.

REFERENCES

1. W. Bruce Fye WB. Presidential Address: The Origins and Evolution of the Mayo Clinic from 1864 to 1939: A Minnesota Family Practice Becomes an International "Medical Mecca" *Bull Hist Med*. 2010;84(3):323-357. doi:10.1353/bhm.2010.0019

2. Muhlestein DB, Smith NJ. Physician Consolidation: Rapid Movement From Small To Large Group Practices, 2013-15. *Health Aff (Millwood)*. 2016;35(9):1638-1642. doi:10.1377/hlthaff.2016.0130

3. Burns LR, Goldsmith JC, Sen A. Horizontal and vertical integration of physicians: a tale of two tails. *Adv Health Care Manag*. 2013;15:39-117. http://www.ncbi.nlm.nih.gov/pubmed/24749213. Accessed August 8, 2017.

4. Liebhaber A, Grossman JM. Physicians moving to mid-sized, single-specialty practices. *Track Rep*. 2007;(18):1-5. http://www.ncbi.nlm.nih.gov/pubmed/17710764. Accessed August 1, 2018.

5. Paulick JM, Roos NP. The young physician: types of practice. *Can Med Assoc J*. 1978;118(3):276-278. http://www.ncbi.nlm.nih.gov/pubmed/630486. Accessed August 6, 2018.

6. Breon TA. Rural Surgical Practice: An Iowa Group Model. *Surg Clin North Am*. 2009;89(6):1359-1366. doi:10.1016/j.suc.2009.07.012

7. Damiani G, Silvestrini G, Federico B, et al. A systematic review on the effectiveness of group versus single-handed practice. *Health Policy*. 2013;113(1-2):180-187.

doi:10.1016/j.healthpol.2013.07.008

8. Devlin RA, Hogg W, Zhong J, Shortt M, Dahrouge S, Russell G. Practice size, financial sharing and quality of care. *BMC Health Serv Res*. 2013;13(1):446. doi:10.1186/1472-6963-13-446

9. Feron J-M, Cerexhe F, Pestiaux D, et al. GPs working in solo practice: obstacles and motivations for working in a group? A qualitative study. *Fam Pract*. 2003;20(2):167-172. http://www.ncbi.nlm.nih.gov/pubmed/12651791. Accessed August 3, 2018.

10. Hays RB, Sanderson L. Forming large group practices: is it worth it? *Med J Aust*. 1994;161(8):494-496. http://www.ncbi.nlm.nih.gov/pubmed/7935126. Accessed August 5, 2018.

11. Casalino LP, Devers KJ, Lake TK, Reed M, Stoddard JJ. Benefits of and Barriers to Large Medical Group Practice in the United States. *Arch Intern Med*. 2003;163(16):1958. doi:10.1001/archinte.163.16.1958

12. Crane HS, Dennis DA. Risks of a large group practice: a personal experience. *Clin Orthop Relat Res*. 2003;(407):67-70. http://www.ncbi.nlm.nih.gov/pubmed/12567131. Accessed August 3, 2018.

13. Casalino LP, Pham H, Bazzoli G. Growth Of Single-Specialty Medical Groups. *Health Aff*. 2004;23(2):82-90. doi:10.1377/hlthaff.23.2.82

14. Williams AP, Vayda E, Stevenson HM, Burke M, Pierre KD. A typology of medical practice organization in Canada. Data from a national survey of physicians. *Med Care*. 1990;28(11):995-1004. http://www.ncbi.nlm.nih.gov/pubmed/2250495. Accessed August

5, 2018.

15. Bailey RM. A comparison of internists in solo and fee-for-service group practice in the San Francisco Bay area. *Bull N Y Acad Med*. 1968;44(11):1293-1303. http://www.ncbi.nlm.nih.gov/pubmed/19312791. Accessed August 6, 2018.

16. Rothenberger DA. Physician Burnout and Well-Being: A Systematic Review and Framework for Action. *Dis Colon Rectum*. 2017;60(6):567-576. doi:10.1097/DCR.0000000000000844

17. West CP, Dyrbye LN, Erwin PJ, Shanafelt TD. Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis. *Lancet*. 2016;388(10057):2272-2281. doi:10.1016/S0140-6736(16)31279-X

18. Shanafelt TD, Hasan O, Dyrbye LN, et al. Changes in Burnout and Satisfaction With Work-Life Balance in Physicians and the General US Working Population Between 2011 and 2014. *Mayo Clin Proc*. 2015;90(12):1600-1613. doi:10.1016/j.mayocp.2015.08.023

19. Romano M. United we do quite well, thank you. Survey: physicians say practicing in groups is a better way to provide care. *Mod Healthc*. 2001;31(12):34. http://www.ncbi.nlm.nih.gov/pubmed/11299949. Accessed August 4, 2018.

20. Heimeshoff M, Schreyögg J, Kwietniewski L. Cost and technical efficiency of physician practices: a stochastic frontier approach using panel data. *Health Care Manag Sci*. 2014;17(2):150-161. doi:10.1007/s10729-013-9260-0

21. Kwietniewski L, Schreyögg J. Profit efficiency of physician practices: a stochastic frontier approach using panel data. *Health Care Manag Sci*. 2018;21(1):76-86.

doi:10.1007/s10729-016-9378-y

22. Rodríguez C, Pozzebon M. The implementation evaluation of primary care groups of practice: a focus on organizational identity. *BMC Fam Pract*. 2010;11(1):15. doi:10.1186/1471-2296-11-15

23. Tourigny A, Aubin M, Haggerty J, et al. Patients' perceptions of the quality of care after primary care reform: Family medicine groups in Quebec. *Can Fam Physician*. 2010;56(7):e273-82. http://www.ncbi.nlm.nih.gov/pubmed/20631263. Accessed August 1, 2018.

24. Kash B, Tan D. Physician Group Practice Trends : A Comprehensive Review. *J Hosp Med Manag*. 2016;2(1:3):1-8. doi:10.4172/2471-9781.10008

25. Arksey H, O'Malley L. Scoping studies: Towards a methodological framework. *Int J Soc Res Methodol Theory Pract*. 2005;8(1):19-32. doi:10.1080/1364557032000119616

26. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci*. 2010;5(1):69. doi:10.1186/1748-5908-5-69

27. Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2018;169(7):467-473. doi:10.7326/M18-0850

28. Zwiep TM, Greenberg JA, Balaa F, et al. Impact of group practices on patients, physicians and healthcare systems: protocol for a scoping review. *BMJ Open*. 2018;8(9):e022164. doi:10.1136/bmjopen-2018-022164

29. McGowan J, Sampson M, Salzwedel DM, Cogo E, Foerster V, Lefebvre C. PRESS Peer

Review of Electronic Search Strategies: 2015 Guideline Statement. *J Clin Epidemiol*. 2016;75:40-46. doi:10.1016/j.jclinepi.2016.01.021

30. Colorafi KJ, Evans B. Qualitative Descriptive Methods in Health Science Research. *HERD Heal Environ Res Des J*. 2016;9(4):16-25. doi:10.1177/1937586715614171

31. Core Values, Ethics, Spectrum – The 3 Pillars of Public Participation - International Association for Public Participation. https://www.iap2.org/page/pillars. Accessed November 16, 2020.

32. Gawande SR, Benroth R. Comparison of patient satisfaction results during a period of rapid growth for a specialty group practice. *Am J Orthop (Belle Mead NJ)*. 1999;28(4):236-238. http://www.ncbi.nlm.nih.gov/pubmed/10220095. Accessed August 4, 2018.

33. van den Heuvel B, Vair B, Porter G, Klassen D, Inglis K, Bonjer HJ. Patient compliance with a group model of care: the hernia clinic. *Can J Surg*. 2012;55(4):259-263. doi:10.1503/cjs.002811

34. Cohidon C, Wild P, Senn N. Patient experience in primary care: association with patient, physician and practice characteristics in a fee-for-service system. *Swiss Med Wkly*. 2018;148(1314):w14601. doi:10.4414/smw.2018.14601

35. Ellis SD, Karim SA, Vukas RR, Marx D, Uddin J. Four Needles in a Haystack: A Systematic Review Assessing Quality of Health Care in Specialty Practice by Practice Type. *Inquiry*. 2018;55:46958018787041. doi:10.1177/0046958018787041

36. Ritchey FJ. Solo and Group Physician Practices, Family-Physician Relationships and

Unmet Critical Health Need in Rural Areas. In: *Annual Meeting of the Southwestern Sociological Association*. San Antonio; 1975.

37. Fryer A-K, Friedberg MW, Thompson RW, Singer SJ. Patient perceptions of integrated care and their relationship to utilization of emergency, inpatient and outpatient services. *Healthcare*. 2017;5(4):183-193. doi:10.1016/j.hjdsi.2016.12.005

38. Visca M, Donatini A, Gini R, et al. Group versus single handed primary care: a performance evaluation of the care delivered to chronic patients by Italian GPs. *Health Policy*. 2013;113(1-2):188-198. doi:10.1016/j.healthpol.2013.05.016

39. Roos NP. Impact of the organization of practice on quality of care and physician productivity. *Med Care*. 1980;18(4):347-359. http://www.ncbi.nlm.nih.gov/pubmed/7401696. Accessed August 6, 2018.

40. Cohen DI, Breslau D, Porter DK, et al. Academic group practice. The patient's perspective. *Med Care*. 1986;24(11):990-998. http://www.ncbi.nlm.nih.gov/pubmed/3773581. Accessed August 5, 2018.

41. Graham FE. Group versus solo practice: arguments and evidence. *Inquiry*. 1972;9(2):49-60. http://www.ncbi.nlm.nih.gov/pubmed/4262710. Accessed August 6, 2018.

42. Gaal S, van den Hombergh P, Verstappen W, Wensing M. Patient safety features are more present in larger primary care practices. *Health Policy (New York)*. 2010;97(1):87-91. doi:10.1016/j.healthpol.2010.03.007

43. Xierali IM. Physician Multisite Practicing: Impact on Access to Care. *J Am Board Fam Med*. 2018;31(2):260-269. doi:10.3122/jabfm.2018.02.170287

44. Stol DM, Hollander M, Nielen MMJ, Badenbroek IF, Schellevis FG, de Wit NJ. Implementation of selective prevention for cardiometabolic diseases; are Dutch general practices adequately prepared? *Scand J Prim Health Care*. 2018;36(1):20-27. doi:10.1080/02813432.2018.1426151

45. Bardos J, Loudon H, Rekawek P, Friedman F, Brodman M, Fox N. The Association between Solo versus Group Obstetrical Practice Model and Delivery Outcomes. *Am J Perinatol*. November 2018. doi:10.1055/s-0038-1675328

46. Ly DP, Glied SA. Variations in the service quality of medical practices. *Am J Manag Care*. 2013;19(11):e378-85. http://www.ncbi.nlm.nih.gov/pubmed/24511996. Accessed July 30, 2018.

47. Orrantia E. Marathon works. How to thrive in rural practice. *Can Fam Physician*. 2005;51:1217-1221. http://www.ncbi.nlm.nih.gov/pubmed/16190174. Accessed August 3, 2018.

48. Campbell JL, Ramsay J, Green J. Practice size: impact on consultation length, workload, and patient assessment of care. *Br J Gen Pract*. 2001;51(469):644-650. http://www.ncbi.nlm.nih.gov/pubmed/11510394. Accessed August 4, 2018.

49. Lin H-C, Xirasagar S, Laditka JN. Patient perceptions of service quality in group versus solo practice clinics. *Int J Qual Heal care J Int Soc Qual Heal Care*. 2004;16(6):437-445. doi:10.1093/intqhc/mzh072

50. Perkins RB, Anderson BL, Gorin SS, Schulkin JA. Challenges in cervical cancer prevention: a survey of U.S. obstetrician-gynecologists. *Am J Prev Med*. 2013;45(2):175-181. doi:10.1016/j.amepre.2013.03.019

51. Ashworth M, Armstrong D. The relationship between general practice characteristics and quality of care: a national survey of quality indicators used in the UK Quality and Outcomes Framework, 2004-5. *BMC Fam Pract*. 2006;7(1):68. doi:10.1186/1471-2296-7-68

52. Pichetti S, Sermet C, Godman B, Campbell SM, Gustafsson LL. Multilevel analysis of the influence of patients' and general practitioners' characteristics on patented versus multiple-sourced statin prescribing in France. *Appl Health Econ Health Policy*. 2013;11(3):205-218. doi:10.1007/s40258-013-0014-4

53. Kuyvenhoven MM, Pieters HM, Jacobs HM, Touw-Otten FW, Spreeuwenberg C. Do peer consultations improve quality of care in general practice? *Qual Assur Heal care Off J Int Soc Qual Assur Heal Care*. 1990;2(2):171-179. http://www.ncbi.nlm.nih.gov/pubmed/2103882. Accessed August 5, 2018.

54. Rittenhouse DR, Casalino LP, Shortell SM, et al. Small and medium-size physician practices use few patient-centered medical home processes. *Health Aff (Millwood)*. 2011;30(8):1575-1584. doi:10.1377/hlthaff.2010.1210

55. Wiley JA, Rittenhouse DR, Shortell SM, et al. Managing chronic illness: physician practices increased the use of care management and medical home processes. *Health Aff (Millwood)*. 2015;34(1):78-86. doi:10.1377/hlthaff.2014.0404

56. Baker LC, Pesko M, Ramsay P, Casalino LP, Shortell SM. Are Changes in Medical Group Practice Characteristics Over Time Associated With Medicare Spending and Quality of Care? *Med Care Res Rev*. November 2018:107755871881293. doi:10.1177/1077558718812939

57. Freemyer B, Stoff B. Ethical challenges with treating nonadherent patients in a group practice setting. *J Am Acad Dermatol*. 2018;79(3):596-598. doi:10.1016/j.jaad.2017.10.009

58. Sellers EM. The influences of group and independent general practice on patient care: A comparative study in Ontario. *Can Med Assoc J*. 1965;93:147-157. http://www.ncbi.nlm.nih.gov/pubmed/14323656. Accessed August 6, 2018.

59. Hollenbeck BK, Kaufman SR, Yan P, et al. Urologist Practice Affiliation and Intensity-modulated Radiation Therapy for Prostate Cancer in the Elderly. *Eur Urol*. 2018;73(4):491-498. doi:10.1016/j.eururo.2017.08.001

60. Landon BE. Use of quality indicators in patient care: a senior primary care physician trying to take good care of his patients. *JAMA*. 2012;307(9):956-964. doi:10.1001/jama.2012.119

61. Pasternak DP, Tuttle WC, Smith HL. Physician satisfaction in group practice: a comparison of primary care physicians with specialists. *GHAA J*. 1986;7(1):50-59. http://www.ncbi.nlm.nih.gov/pubmed/10277486. Accessed August 5, 2018.

62. Viehmann A, Kersting C, Thielmann A, Weltermann B. Prevalence of chronic stress in general practitioners and practice assistants: Personal, practice and regional characteristics. De Socio GV, ed. *PLoS One*. 2017;12(5):e0176658. doi:10.1371/journal.pone.0176658

63. Koppula S, Brown JB, Jordan JM. Experiences of Family Physicians Who Practise Primary Care Obstetrics in Groups. *J Obstet Gynaecol Canada*. 2011;33(2):121-126. doi:10.1016/S1701-2163(16)34796-X

64. Hueston WJ. Family physicians' satisfaction with practice. *Arch Fam Med*. 1998;7(3):242-247. http://www.ncbi.nlm.nih.gov/pubmed/9596458. Accessed August 4, 2018.

65. Dowell AC, Hamilton S, McLeod DK. Job satisfaction, psychological morbidity and job stress among New Zealand general practitioners. *N Z Med J*. 2000;113(1113):269-272. http://www.ncbi.nlm.nih.gov/pubmed/10935564. Accessed August 4, 2018.

66. Streu R, Hawley S, Gay A, Salem B, Abrahamse P, Alderman AK. Satisfaction with Career Choice among U.S. Plastic Surgeons: Results from a National Survey. *Plast Reconstr Surg*. 2010;126(2):636-642. doi:10.1097/PRS.0b013e3181de1912

67. Nørøxe KB, Pedersen AF, Bro F, Vedsted P. Mental well-being and job satisfaction among general practitioners: a nationwide cross-sectional survey in Denmark. *BMC Fam Pract*. 2018;19(1):130. doi:10.1186/s12875-018-0809-3

68. Connor RA, Hillson SD, Kralewski JE. An analysis of physician recruitment strategies in rural hospitals. *Health Care Manage Rev*. 1995;20(1):7-18. http://www.ncbi.nlm.nih.gov/pubmed/7744608. Accessed August 4, 2018.

69. Verbeek-Heida PM. General practitioners' attitudes towards group practice in the Netherlands. *Soc Sci Med*. 1969;3(2):249-258. http://www.ncbi.nlm.nih.gov/pubmed/5346690. Accessed August 6, 2018.

70. Stamps PL. Physicians and organizations: an uneasy alliance or a welcome relief? *J Fam Pract*. 1995;41(1):27-32. http://www.ncbi.nlm.nih.gov/pubmed/7798063. Accessed August 4, 2018.

71. Moosa S, Luiz J, Carmichael T, Peersman W, Derese A. Insights of private general practitioners in group practice on the introduction of National Health Insurance in South Africa. *African J Prim Heal Care Fam Med*. 2016;8(1). doi:10.4102/phcfm.v8i1.1025

72. Evashwick CJ. The role of group practice in the distribution of physicians in nonmetropolitan areas. *Med Care*. 1976;14(10):808-823. http://www.ncbi.nlm.nih.gov/pubmed/972559. Accessed August 6, 2018.

73. Streu R, Hansen J, Abrahamse P, Alderman AK. Professional burnout among US plastic surgeons: results of a national survey. *Ann Plast Surg*. 2014;72(3):346-350. doi:10.1097/SAP.0000000000000056

74. Orton P, Orton C, Pereira Gray D. Depersonalised doctors: a cross-sectional study of 564 doctors, 760 consultations and 1876 patient reports in UK general practice. *BMJ Open*. 2012;2(1):e000274. doi:10.1136/bmjopen-2011-000274

75. Mahoney AR. Factors affecting physicians' choice of group or independent practice. *Inquiry*. 1973;10(2):9-18. http://www.ncbi.nlm.nih.gov/pubmed/4268320. Accessed August 6, 2018.

76. Mosaly PR, Mazur LM, Jones EL, et al. Quantifying the impact of cross coverage on physician's workload and performance in radiation oncology. *Pract Radiat Oncol*. 2013;3(4):e179-86. doi:10.1016/j.prro.2013.02.007

77. Rivet C, Ryan B, Stewart M. Hands on: is there an association between doing procedures and job satisfaction? *Can Fam Physician*. 2007;53(1):93, 93:e.1-5, 92. http://www.ncbi.nlm.nih.gov/pubmed/17872615. Accessed August 1, 2018.

78. Schulte BM, Mannino DM, Royal KD, Brown SL, Peterson LE, Puffer JC. Community size and organization of practice predict family physician recertification success. *J Am Board Fam Med*. 2014;27(3):383-390. doi:10.3122/jabfm.2014.03.130016

79. Valentine MA, Barsade S, Edmondson AC, Gal A, Rhodes R. Informal Peer Interaction and Practice Type as Predictors of Physician Performance on Maintenance of Certification Examinations. *JAMA Surg*. 2014;149(6):597-603. doi:10.1001/jamasurg.2014.183

80. Curoe A, Kralewski J, Kaissi A. Assessing the cultures of medical group practices. *J Am Board Fam Pract*. 2003;16(5):394-398. http://www.ncbi.nlm.nih.gov/pubmed/14645329. Accessed August 3, 2018.

81. Solberg LI, Hroscikoski MC, Sperl-Hillen JM, Harper PG, Crabtree BF. Transforming medical care: case study of an exemplary, small medical group. *Ann Fam Med*. 2006;4(2):109-116. doi:10.1370/afm.424

82. Zazzali JL, Alexander JA, Shortell SM, Burns LR. Organizational Culture and Physician Satisfaction with Dimensions of Group Practice. *Health Serv Res*. 2007;42(3p1):1150-1176. doi:10.1111/j.1475-6773.2006.00648.x

83. Masselink LE, Lee S-YD, Konrad TR. Workplace relational factors and physicians' intention to withdraw from practice. *Health Care Manage Rev*. 2008;33(2):178-187. doi:10.1097/01.HMR.0000304507.50674.28

84. Suchman A, Mainali E, Hoffer Gittel J. Society of General Internal Medicine 34th Annual Meeting ABSTRACTS OF SUBMISSIONS. In: *ADDRESSING CHRONIC CONFLICT AND PROBLEMATIC BEHAVIORS IN A GROUP PRACTICE*. ; 2011:S556.

85. Lowes R. Group practices pay better. *Med Econ*. 2007;84(22):23-25. http://www.ncbi.nlm.nih.gov/pubmed/18159882. Accessed August 1, 2018.

86. Lin H-C, Chen C-S, Liu T-C, Lee H-C. Differences in practice income between solo and group practice physicians. *Health Policy (New York)*. 2006;79(2-3):296-305. doi:10.1016/j.healthpol.2006.01.008

87. McCormick IR, Thomson AN. What future for solo general practice? *N Z Med J*. 1989;102(877):530-532. http://www.ncbi.nlm.nih.gov/pubmed/2797588. Accessed August 5, 2018.

88. Graham JW. Comparisons of solo practices and group practices. *J Oral Surg*. 1979;37 Spec No A:A65-82. http://www.ncbi.nlm.nih.gov/pubmed/285253. Accessed August 6, 2018.

89. Rose I. Aspects of group medical practice. *Can Med Assoc J*. 1968;98(23):1118. http://www.ncbi.nlm.nih.gov/pubmed/20329241. Accessed August 6, 2018.

90. Davies S. General practice costs survey for financial year 1977/78. *N Z Med J*. 1979;90(639):20-23. http://www.ncbi.nlm.nih.gov/pubmed/290889. Accessed August 6, 2018.

91. Kwietniewski L, Heimeshoff M, Schreyögg J. Estimation of a physician practice cost function. *Eur J Heal Econ*. 2017;18(4):481-494. doi:10.1007/s10198-016-0804-3

92. Kimbell LJ, Lorant JH. Physician productivity and returns to scale. *Health Serv Res*. 1977;12(4):367-379. http://www.ncbi.nlm.nih.gov/pubmed/591349. Accessed August 6, 2018.

93. Mazurenko O, Hearld LR, Menachemi N. The relationship between the external environment and physician e-mail communication: The mediating role of health information technology availability. *Health Care Manage Rev*. 2017;42(2):122-131. doi:10.1097/HMR.0000000000000095

94. Xierali IM, Phillips RL, Green LA, Bazemore AW, Puffer JC. Factors influencing family physician adoption of electronic health records (EHRs). *J Am Board Fam Med*. 2013;26(4):388-393. doi:10.3122/jabfm.2013.04.120351

95. Rao SR, DesRoches CM, Donelan K, Campbell EG, Miralles PD, Jha AK. Electronic health records in small physician practices: availability, use, and perceived benefits. *J Am Med Informatics Assoc*. 2011;18(3):271-275. doi:10.1136/amiajnl-2010-000010

96. Terris M. Introduction: Origins and growth of group practice. *Bull N Y Acad Med*. 1968;44(11):1277-1281. http://www.ncbi.nlm.nih.gov/pubmed/19312788. Accessed August 6, 2018.

97. Weinerman ER. Problems and perspectives of group practice. *Bull N Y Acad Med*. 1968;44(11):1423-1434. http://www.ncbi.nlm.nih.gov/pubmed/19312816. Accessed August 6, 2018.

98. Sturm R. Effect of managed care and financing on practice constraints and career satisfaction in primary care. *J Am Board Fam Pract*. 2002;15(5):367-377. http://www.ncbi.nlm.nih.gov/pubmed/12350059. Accessed August 4, 2018.

99. Sturm R. The impact of practice setting and financial incentives on career satisfaction and perceived practice limitations among surgeons. *Am J Surg*. 2002;183(3):222-225. http://www.ncbi.nlm.nih.gov/pubmed/11943115. Accessed August 3, 2018.

100. Holden DM. Rural practice modes. *Acad Med*. 1990;65(12 Suppl):S32-40. http://www.ncbi.nlm.nih.gov/pubmed/2252515. Accessed August 5, 2018.

101. Schryver DL, Niederman GA, Johnson BA. Establishing a group practice "without walls". *Health Care Strateg Manage*. 1993;11(1):18-21. http://www.ncbi.nlm.nih.gov/pubmed/10123389. Accessed August 5, 2018.

102. Wallace JD. Group practice: the way of the future? *Can Med Assoc J*. 1974;111(6):571. http://www.ncbi.nlm.nih.gov/pubmed/20312564. Accessed August 6, 2018.

103. Kralewski J, Dowd B, Knutson D, Tong J, Savage M. The Relationships of Physician Practice Characteristics to Quality of Care and Costs. *Health Serv Res*. 2015;50(3):710-729. doi:10.1111/1475-6773.12242

104. Kwietniewski L, Schreyögg J. Efficiency of physician specialist groups. *Health Care Manag Sci*. 2018;21(3):409-425. doi:10.1007/s10729-017-9394-6

105. Bland ES, Oppenheimer LW, Holmes P, Wen SW. The effect of income pooling within a call group on rates of obstetric intervention. *CMAJ*. 2001;164(3):337-339. http://www.ncbi.nlm.nih.gov/pubmed/11232133. Accessed August 4, 2018.

106. Defelice LC, Bradford WD. Relative inefficiencies in production between solo and group practice physicians. *Health Econ*. 1997;6(5):455-465. http://www.ncbi.nlm.nih.gov/pubmed/9353646. Accessed August 4, 2018.

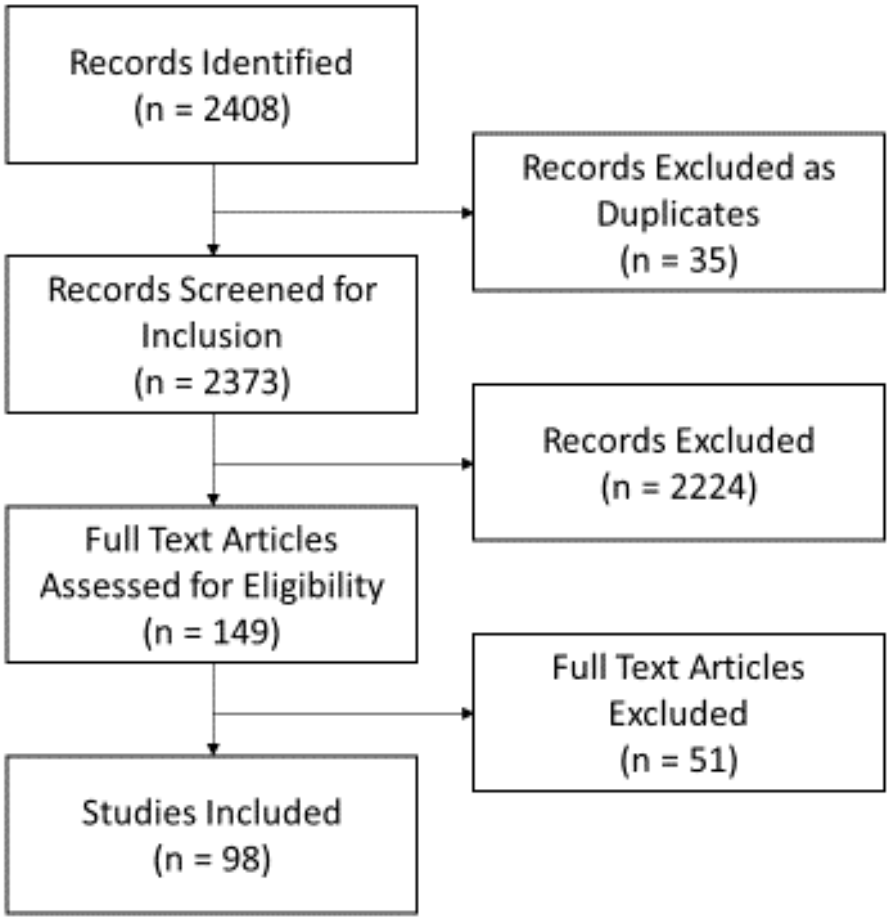

Figure 1 - PRISMA flow diagram for screened and included papers.

Database: Embase Classic+Embase <1947 to 2018 October 20>, Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Search Strategy:
---
1 Group Practice/ (16988)
2 (group practice* or group medical practice* or group model or group models).tw. (14652)
3 1 or 2 (26886)
4 physicians/ or allergists/ or anesthesiologists/ or cardiologists/ or dermatologists/ or endocrinologists/ or gastroenterologists/ or geriatricians/ or nephrologists/ or neurologists/ or oncologists/ or radiation oncologists/ or ophthalmologists/ or otolaryngologists/ or pediatricians/ or neonatologists/ or pulmonologists/ or radiologists/ or rheumatologists/ or surgeons/ or neurosurgeons/ or orthopedic surgeons/ (443392)
5 (allerg* or an?esthesiolog* or cardiolog* or clinician* or dermatolog* or endocrinolog* or gastroenterolog* or geriatrician* or gerontol* or gyn?ecolog* or h?ematolog* or nephrolog* or neurolog* or obstetric* or oncolog* or ophthalmolog* or otolaryngolog* or patholog* or p?ediatrician* or neonatolog* or physiatr* or pulmonolog* or orthop?ed* or radiolog* or rheumatolog* or surgeon* or neurosurgeon* or urolog* or general practitioner*).tw. (5716273)
6 general practitioners/ or physicians, family/ or physicians, primary care/ or Primary Health Care/ (224656)
7 (general practitioner* or family physician* or primary care physician*).tw. (170297)
8 physician*.ab. /freq=3 (121030)
9 or/4-8 (6177351)
10 3 and 9 (7625)
11 (group physician* or group surgeon*).tw. (683)
12 10 or 11 (8258)
13 income/ or exp pensions/ or remuneration/ or exp "salaries and fringe benefits"/ (144814)
14 prognosis/ or exp treatment outcome/ (3037613)
15 "Outcome Assessment (Health Care)"/ (306264)
16 personal satisfaction/ or job satisfaction/ (99372)
17 exp Patient Satisfaction/ (191942)
18 (satisfaction or patient reported outcome*).tw. (275754)
19 "Quality of Life"/ (522787)
20 "quality of health care"/ or quality assurance, health care/ (297926)
21 (income or salary).tw. (205853)
22 Life Style/ (134714)
23 life style.tw. (24521)
24 lifestyle.tw. (167173)
25 quality.mp. (2447101)
26 Stress, Psychological/ (166129)
27 Burnout, Professional/ (18655)
28 (burnout or stress).tw. (1383633)
29 perception of care.tw. (479)
30 models, organizational/ (62847)
31 organi?ation* model*.tw. (2367)
32 Physician-Patient Relations/ (177062)
33 (patient adj2 physician adj3 relation*).tw. (7804)
34 (revenue* or profit or profits).tw. (52523)
35 insurance, health, reimbursement/ or reimbursement mechanisms/ or reimbursement, incentive/ (73589)
36 or/13-35 (7492929)
37 12 and 36 (3422)
38 group practice*.ti,kw. or (group medical practice* or medical group practice*).tw,kw. (4213)
39 ("in data review" or in process or "pubmed not medline").st. (2785791)
40 38 and 39 (62)
41 37 or 40 (3481)

42 limit 41 to english language (3323)
43 42 use ppez (1607)
44 *group practice/ (11289)
45 (group practice* or group medical practice* or group model or group models).tw. (14652)
46 44 or 45 (22481)
47 *physician/ or *anesthesiologist/ or *cardiologist/ or *dermatologist/ or *emergency physician/ or *endocrinologist/ or *gastroenterologist/ or *general practitioner/ or *geriatrician/ or *gerontologist/ or *gynecologist/ or *hematologist/ or *hospital physician/ or *immunologist/ or *intensivist/ or *internist/ or *neonatologist/ or *nephrologist/ or *neurologist/ or *obstetrician/ or exp *oncologist/ or *ophthalmologist/ or *orthopedic specialist/ or *otolaryngologist/ or *pathologist/ or *pediatrician/ or *physiatrist/ or psychiatrist/ or *pulmonologist/ or exp *radiologist/ or *rheumatologist/ or exp *surgeon/ or *urologist/ (262673)
48 (allerg* or an?esthesiolog* or cardiolog* or clinician* or dermatolog* or endocrinolog* or gastroenterolog* or geriatrician* or gerontol* or gyn?ecolog* or h?ematolog* or nephrolog* or neurolog* or obstetric* or oncolog* or ophthalmolog* or otolaryngolog* or patholog* or p?ediatrician* or neonatolog* or physiatr* or pulmonolog* or orthop?ed* or radiolog* or rheumatolog* or surgeon* or neurosurgeon* or urolog* or general practitioner*).tw. (5716273)
49 (family physician* or primary care physician*).tw. (68204)
50 physician*.ab. (702496)
51 47 or 48 or 49 or 50 (6368299)
52 46 and 51 (6994)
53 (group physician* or group surgeon*).tw. (683)
54 52 or 53 (7627)
55 exp *"salary and fringe benefit"/ or *income/ (26491)
56 exp *treatment outcome/ (62134)
57 exp *"quality of life"/ (156501)
58 *health care quality/ (102682)
59 quality.tw. (1879375)
60 (income or salary).tw. (205853)
61 *lifestyle/ (32389)
62 (life style or lifestyle).tw. (189605)
63 *stress/ or *burnout/ (63482)
64 (burnout or stress).tw. (1383633)
65 "perception of care".tw. (479)
66 health care organization/ (123801)
67 organi?ation* model*.tw. (2367)
68 *doctor patient relation/ (68839)
69 (patient adj2 physician adj3 relation*).tw. (7804)
70 (revenue* or profit or profits).tw. (52523)
71 *reimbursement/ or *health insurance/ (81697)
72 *health care quality/ (102682)
73 *patient satisfaction/ (45768)
74 *satisfaction/ or *job satisfaction/ or *life satisfaction/ (37526)
75 satisfaction.tw. (253885)
76 patient reported outcome*.tw. (25479)
77 or/55-76 (4161152)
78 54 and 77 (2598)
79 limit 78 to english language (2485)
80 79 use emczd (1433)
81 conference abstract.pt. (2652420)
82 80 and 81 (152) Embase Conferences
83 80 not 82 (1281)
84 43 or 83 (2888)
85 remove duplicates from 84 (2105)
86 85 use ppez (1554) Medline
87 85 use emczd (551) Embase

Supplementary Appendix B

Table 1 - Papers Assessing Patient Outcomes

Author	Study Design	Population Studied	Key Findings
Sellers, 1965	Retrospective cohort study	Patients Physicians	More laboratory investigations and consultations for group practice patients and patients report more personal attention and in-depth explanations of a diagnosis and treatment by physicians in solo practices.
Graham, 1972	Review	Physicians	Limited evidence shows improvement in accessibility, continuity, quality, and efficiency with group practices. Potential drawbacks included dilution of the doctor-patient relationship and less autonomy.
Ritchey, 1975	Survey	Patients	Patients with solo GPs have better relationships with their physicians. Patients with GPs in group practice have greater unmet needs.
Roos, 1980	Retrospective Cohort study	Physicians	Quality of care and productivity were not found to be different for physicians in solo vs group practices in Manitoba.
Cohen et al., 1986	RCT	Patients Physicians Allied Health	Patients were randomized to a new group practice model and found no changes to patient satisfaction but there was a decrease in charges and utilization for patients as well as improved access to care, and decreased

			waiting times.
Kuyvenhoven et al., 1990	Survey	Patients Physicians	GPs in the Netherlands were surveyed and 20% of solo physicians stated that they never consulted their peers, while those working in a group practice did so regularly, which was found to help improve the level of attention paid to somatic complaints.
Gawande & Benroth, 1999	Survey	Patients Physicians	Patient satisfaction increased following the expansion of a group practice from 18 to 36 orthopedic surgeons in Indianapolis. This was felt to be due to decreased waiting times and increased time spent with a surgeon.
Campbell et al., 2001	Survey	Patients Physicians Healthcare Systems	Solo GP practices have shorter consultation lengths (15.2 min) vs group practices (17.8 min).
Lin et al., 2004	Survey	Patients	Patients perceive better overall quality of care in primary care group practices compared to solo practices with regards to equipment, facilities, reliability, responsiveness, assurance, and empathy.
Orrantia, 2005	Case Report	Patients Physicians	A family group practice that was established in Marathon, Ontario allowed for the maintenance of a stable number of physicians and also allowed for

			increased health care services offered to the community.
Ashworth & Armstrong, 2006	Survey	Patients Physicians	Group practices obtained significantly higher Quality and Outcomes Framework scores in the UK when compared to solo practices.
Breon, 2009	Case Report	Physicians Healthcare Systems	After the establishment of a surgical group practice in rural Iowa by five surgeons the access to surgical care at multiple hospitals improved and shared call coverage was achieved.
Gaal et al., 2010	Survey	Physicians	Larger primary care practices in Europe were found to have more patient safety features present, but clinical outcomes were not assessed in this paper.
Tourigny et al., 2010	Survey	Patients	Patient perception of continuity of care increased, accessibility remained the same, and physician co-ordination with specialists decreased in this before and after study following implementation of group practices in Quebec.
Weeks et al., 2010	Cross-sectional Study	Patients	Large multispecialty group practices enrolled with the Council of Accountable Physician Practices delivered better quality of care at a lower cost than other groups.
Rittenhouse	Survey	Patients	Larger groups used more patient-centered medical home processes than solo or

et al., 2011			2 physician groups.
Landon, 2012	Conference	Healthcare Systems	A primary care internist who moved from a small practice to a large group practice after many years found that the level of care he was providing was compromised by the large group and payers setting targets for the group.
van den Heuvel et al., 2012	Survey	Patients	From a survey of patients seen in a group practice hernia clinic, most were found to be satisfied with any surgeon from the group performing their surgery, even if they hadn't met them until the day of surgery, and felt that the group practice allowed for more efficient use of resources.
Damiani et al., 2013	Systematic Review	Patients Physicians Healthcare Systems	GP group practices had positive impacts on prescribing appropriateness compared to solo practices. Other quality measures were found to have insufficient evidence in the included papers.
Devlin et al., 2013	Survey	Patients Physicians	Larger family physician group practices were associated with better access to care, comprehensiveness, and disease prevention. Continuity of care was negatively affected.
Ly & Glied, 2013	Survey	Patients Physicians	Large primary care group practices (> 10 physicians) in the United States were found to have shorter waiting times by 14 minutes for patients.

Mehrotra et al., 2013	Cross-sectional Study	Patients	Patients in integrated medical groups received higher quality care based on 6 quality measures compared to independent practice associations. The self-reported use of electronic medical records was higher as well.
Perkins et al., 2013	Survey	Physicians	Obstetricians and Gynecologists in the United States are more likely to adhere to established cervical cancer prevention guidelines if they are part of a group practice, possibly because of improved knowledge sharing and access to information.
Pichetti et al., 2013	Survey	Physicians	In France, those who work in groups were more likely to prescribe multiple sourced rather than patented statins than solo practitioners.
Visca et al., 2013	Survey	Patients Physicians	No clinically significant difference was found between solo and group practices in the management of chronic diseases by GPs.
Wiley et al., 2015	Survey	Patients Physicians	Processes for the patient-centered medical home model have increased in all group practices sizes over time but are only present in less than half of even large groups. Additionally, a reduction in patient involvement in care was noted over time.
Fryer et al.,	Survey	Patients	The Patient Perceptions of Integrated Care survey identified a decrease in

2017			utilization of emergency department and outpatient resources amongst patient with multiple chronic illnesses who perceived a higher level of integration in the group practice that delivered care to them.
Baker et al., 2018	Survey	Patients Physicians	No significant changes reported in quality measures based on group practice size.
Bardos et al., 2018	Cohort	Patients Physicians	Compared to those in groups, solo obstetricians had a higher Cesarean section rates but lower rates of shoulder dystocia and third or fourth degree tears which was felt to indicate that they had a more conservative approach to labour.
Cohidon et al., 2018	Survey	Patients Physicians	Patients in family physician group practices in Switzerland reported a better experience with continuity and co-ordination of care compared to solo practices. No differences were seen in their experience with access and communication between the practice types.
Ellis et al., 2018	Systematic review	Patients Physicians	In a limited number of studies, patients appeared to be more satisfied with specialist group practices rather than solo practices with respect to tangibles and their own assessment of quality.

Freemyer & Stoff, 2018	Case Report	Patients Physicians	In a group practice, there may be differing opinions and risk tolerance amongst members especially with non-adherent patients and potentially dangerous medications. In order to minimize the effect on continuity of care, physicians in group practices should develop policies around challenging situations and apply these consistently to patients.
Hollenbeck et al., 2018	Cohort	Patients Physicians	Prostate cancer patients were found to be more likely treated with intensity-modulated radiation therapy if the urology group owned radiation facilities regardless of group size even if the treatment was unlikely to be beneficial, suggesting that the financial incentive outweighed best practices in prostate cancer care and that group practices do not prevent conflicts of interest.
Stol et al., 2018	Survey	Physicians	Practices that implemented selective prevention for cardiometabolic diseases were more often group practices rather than solo practices. These practices were also organized better for chronic disease management.
Xierali, 2018	Cross-sectional study	Physicians	Physicians in group practices were more likely to practice at multiple sites which may increase the access to care for patients.

Table 2 – Papers Assessing Physician Outcomes

Author	Study Design	Population Studied	Key Findings
Bailey, 1968	Cohort	Patients Physicians	Physicians, rather than patients, benefit the most from multidisciplinary group practices as their output was lower, fees were higher, and they ordered more tests especially if that service was offered by the group.
Rose, 1968	Letter	Physicians	Income deferral by physicians until later in life when they were less productive was viewed as a benefit of group practices.
Terris, 1968	Letter	Physicians	Group practices were mostly limited to hospitals with most other physicians working in solo practices outside of the hospitals, and it was believed that group practices would not be taken up unless it was established as a desirable form of practice to society and health care professionals.
Weinerman, 1968	Letter	Patients Physicians	Group practices needed to be refocused on patients in order to be relevant to societal needs.
Verbeek-Heida, 1969	Survey	Physicians	A significant desire for contacts and co-operation with other general practitioners led to improved attitudes about group practices in the Netherlands.

Mahoney, 1973	Survey	Physicians	Future surgeons preferred solo practice due to the potential loss of autonomy while future obstetricians and pediatricians preferred practice partnerships, and future internists preferred group practices.
Wallace, 1974	Letter	Physicians	This letter from the secretary-general of the Canadian Medical Association highlighted the possible need for government support to help with the establishment of medical groups.
Evashwick, 1976	Cross-sectional Study	Physicians	Non-metropolitan areas in the United States that have a greater percentage of group practices have better retention and recruitment rates.
Kimbell & Lorant, 1977	Survey	Physicians	In 1979 in the United States, physician annual gross revenue, total patient visits per year, and office visits per year were measured and there were increasing returns to scale for physicians in solo or small group practice and inefficiencies noted in large group practices.
Paulick & Roos, 1978	Survey	Physicians	In Canada, 57% of graduating physicians entered a group practice or partnership, 21% entered solo practice, and 22% became salaried physicians. Surgeons and psychiatrists were most likely to enter solo practice.

Davies, 1979	Survey	Physicians	In 1978 in New Zealand, group practices had higher cost than solo practices.
Graham, 1979	Survey	Physicians	The Manpower Survey of Oral Surgery was performed and it was reported that oral surgeons working in group practices had higher incomes and employed fewer full-time equivalent staff per surgeon.
Pasternak et al., 1986	Survey	Physicians	There was no significant difference in physician satisfaction between those practicing in groups vs those in solo practice in the southwest United States.
McCormick & Thomson, 1989	Survey	Physicians	GPs in solo practice earn less than those in group practices (gross income 19% less) due to lower fees and lower numbers of patients seen.
Holden, 1990	Letter	Physicians	Solo family physician practice in rural areas was in decline and unlikely to succeed as group practices were forming and offering better benefits to graduating residents.
Williams et al., 1990	Survey	Physicians	Half of the physicians were in either solo or group practices and the other half had some group practice arrangements for financial benefits. They hypothesized that future formation of group practices would require some incentives from government, which has happened.

Schryver et al., 1993	Case Report	Physicians	A unique group practice without walls structure is described which allows for the formation of a group with physicians at different locations. The members enjoy the business and professional benefits of a group practice, but this still allows for autonomy, decentralization, and individual practice style.
Hays & Sanderson, 1994	Interviews	Physicians	GPs in Australia who were interested in forming group practices were completed and identified incompatible personalities or practice styles, legal and real estate issues, and initial costs as barriers.
Connor et al., 1995	Survey	Physicians Healthcare Systems	Group practice opportunities are an important aspect in recruiting physicians to practice in a rural hospital in order to reduce isolation, pool resources, and decrease call burden.
Stamps, 1995	Survey	Physicians	Physicians in private group practices were significantly more satisfied with personal and lifestyle factors than those in solo, hospital, or health maintenance organization related practices.
Defelice & Bradford, 1997	Survey	Physicians	Data from the Physicians' Practice Cost and Income Survey found no significant differences in practice efficiency between solo and group primary care practices in the United States.

.136/bmjopen-2020-041578 on 8 January 2021. Downloaded from

Hueston, 1998	Survey	Physicians	GPs associated with solo or small group (≤3 physicians) practices were found to be less satisfied.
Dowell et al., 2000	Survey	Physicians	GPs associated with solo practices were found to be less satisfied than those in group practices.
Bland et al., 2001	Cohort	Patients Physicians	Income pooling within an obstetrical call group in a Canadian study led to decreased rates of elective induction of labour in a before and after study.
Romano, 2001	Letter	Physicians	Group practices generally enhanced United States physicians' quality of life, improved patient care, improved professional development, and led to higher earnings.
Sturm, 2002a	Survey	Physicians	Data from the Community Tracking Study was used to show that surgeons working within a small practice was the greatest predictor of career dissatisfaction and that patient quality of care was impacted by income pressures as well as decreased continuity of care and clinical freedom within solo or 2 surgeon practices.
Sturm, 2002b	Survey	Physicians	Data from the Community Tracking Study found that physicians working within a solo or 2 physician practice was the greatest predictor of career

			dissatisfaction. They also reported less clinical freedom and constraints on income.
Casalino et al., 2003	Survey	Physicians Healthcare systems	Data from the Community Tracking Study was also used to find that the most frequently cited reason for group practice formation was negotiating leverage, and barriers included lack of leadership, physician co-operation, and investment.
Crane & Dennis, 2003	Case Report	Physicians Healthcare systems	The growth and subsequent deterioration of a large orthopedic group practice which amalgamated multiple smaller groups is described. The eventual demise of the practice appeared to be due to poor leadership, disagreements over re-imbursement, differing visions for the future of the group, dissatisfied office staff who were in danger of being let go due to centralization, difficulty in negotiations with payers, and being undercut by smaller competing groups.
Curoe et al., 2003	Survey	Physicians	Physicians in the United States found that as group practice size increases, the culture is less collegial, less cohesive, and there is less organizational trust which was also true for multi-specialty practices compared to single specialty.

Feron et al., 2003	Survey	Physicians	Physicians working in solo practices viewed improved quality of life, knowledge sharing, and continuity of care as motivation to form a group practice. Interpersonal relationships, budget issues, loss of the patient-physician relationship, and differing views of the group were viewed as barriers.
Casalino et al., 2004	Survey	Physicians Healthcare systems	Data from the Community Tracking Study was used to assess the reasons for growth of group practices and it was seen that physicians were increasingly forming single specialty group practices to not only increase the scope of surgical services and diagnostic imaging they could offer, but also gain negotiating leverage with payers.
Lin et al., 2006	Survey	Physicians	In Taiwan, higher incomes were realized by physicians who were in single or multi-specialty groups when compared to solo practice physicians.
Solberg et al., 2006	Survey	Physicians	Within a family medicine group in the United States, categories important to a high level of care included teamwork, leadership, patient centered care, quality improvement, accountability, and a sense of ownership.
Liebhaber &	Letter	Physicians	From 1996/97 to 2004/05, the proportion of physicians in solo or 2 physician

Grossman, 2007			practices decreased from 40.7% to 32.5% and physicians were increasingly forming single specialty rather than multi-specialty group practices.
Lowes, 2007	Survey	Physicians	Primary care physicians in the United States were earning more money if they practiced within groups of more than 50 physicians.
Rivet et al., 2007	Survey	Physicians	Family physicians in solo practice had greater overall job satisfaction in this survey that primarily assessed improved satisfaction associated with performing procedures.
Zazzali, Alexander, Shortell, & Burns, 2007	Survey	Physicians	Stronger group culture emphasizing participation, teamwork, and cohesiveness promoted physician satisfaction. Conversely, a hierarchical structure had a negative effect on satisfaction.
Masselink, Lee, & Konrad, 2008	Survey	Physicians	Data from the Physician Worklife Survey found that good relationships with colleagues in a large group practice led to a decrease in a physician's intent to withdrawal from practice. A similar effect was not seen for physicians in small or solo practices.
Breon, 2009	Case Report	Physicians	After the establishment of a surgical group practice in rural Iowa by five

		Healthcare Systems	surgeons the access to surgical care at multiple hospitals improved and shared call coverage was achieved.
Rodríguez & Pozzebon, 2010	Case Study	Physicians Allied health Healthcare systems	A family medicine group in Quebec was assessed during its formation and difficulties with interpersonal and interprofessional relationships were identified and found to be quite detrimental to the functioning of the team. A new director was able to mend these relationships, improve communication, and move the group forward.
Streu et al., 2010	Survey	Physicians	Working within a group practice led to increased job satisfaction for plastic surgeons as they were less professionally isolated.
Koppula et al., 2011	Interviews	Physicians	Group practices allowed family physicians to have a better work-life balance, collaboration, and support from fellow group members and allowed for continuity of care during and beyond the obstetrical events. Some challenges identified included sustainability (securing locum physicians to cover absences) and conflict within the group.
Rao et al., 2011	Survey	Physicians	Family physicians in the United States in solo practices were found to be less likely to adopt electronic health records when compared to those in group

			practices.
Suchman A et al., 2011	Abstract	Physicians	Chronic conflict, behavioural accountability, and a common vision were addressed in a small group practice through regular meetings, retreats, and an objective assessment by allied health professionals to improve group function.
Orton et al., 2012	Survey	Physicians	Higher rates of depersonalization were identified in GPs in the UK working in group practices vs solo practices which was felt to be due to poor interpersonal relationships as well as increased demands and less autonomy.
Burns et al., 2013	Review	Physicians	Currently, part of the reason larger groups in the United States may be forming is because they are able to leverage insurers more effectively and build up more market share. Groups with over 100 physicians are increasing.
Damiani et al., 2013	Systematic Review	Patients Physicians Healthcare Systems	Greater uptake of health information technology in GP group practices compared to solo practices and a higher satisfaction with compensation was noted.
Mosaly et al., 2013	Abstract	Physicians	Physicians who cross-cover patients may perceive that their workloads are increased, and performance decreased.

Welch et al., 2013	Cross-sectional Study	Physicians	Between 2009 and 2011, groups of greater than 100 physicians continued to increase in number, with a decrease in the number of solo practitioners.
Xierali et al., 2013	Survey	Physicians	Family physicians in solo or small practices were less likely to adopt electronic health records compared to those in larger group practices.
Heimeshoff et al., 2014	Survey	Physicians	Technical efficiencies were higher for group practices, but this was also associated with higher costs compared to solo practices.
Robinson & Miller, 2014	Cross-sectional Study	Physicians	Hospital owned physician groups had higher costs than physician owned groups in California between 2009 and 2012.
Schulte et al., 2014	Survey	Physicians	Family physicians were less likely to pass the American Board of Family Medicine maintenance of certificate exam if they were in a solo practice which was thought to result from the ability to spend more time on quality improvement and education within a group practice (OR 0.48 [95%CI 0.34 – 0.68]).
Streu et al.,	Survey	Physicians	Working in a group practice was identified as a practice characteristic

2014			associated with professional burnout in plastic surgeons and comments from the survey seemed to indicate that this was due to poor interpersonal relationships within groups.
Valentine et al., 2014	Survey	Physicians	Surgeons working in solo practice were less likely to pass their maintenance of certification examination compared to those in group practices (OR 0.22 [95% CI 0.06-0.77]).
Kralewski et al., 2015	Survey	Physicians	Group practices that focus on improved screening and monitoring may improve avoidable utilization, cost, and revenue.
Moosa et al., 2016	Survey	Physicians	GPs working in groups were more optimistic about the future compared to solo practitioners and worked fewer days but saw more patients per day.
Muhlestein & Smith, 2016	Cross-sectional Study	Physicians	Between 2013 and 2015, the largest changes in group practice size were a decrease in small groups and an increase in very large groups of over 100 physicians. Groups of 100 or more increased from 29.6% to 35.1%. Groups with 1-2 physicians decreased from 22.5% to 19.8%.
Fryer et al., 2017	Survey	Patients	Improved utilization of emergency department and outpatient resources amongst patients with chronic illnesses in group practices who perceive a

			higher level of integration.
Gisler, Bachofner, Moser-Bucher, Scherz, & Streit, 2017	Survey	Physicians	Young GPs in Switzerland prefer to work part-time in group practices of up to 5 physicians.
Kwietniewski et al., 2017	Survey	Physicians	Costs of group practices were higher than those of solo practices due to more investment in technological costs that solo practices would not be able to afford.
Mazurenko et al., 2017	Survey	Physicians	Solo physicians had less health information technology and had less email correspondence with patients and other physicians.
Viehmann et al., 2017	Survey	Physicians	Chronic stress was identified in 26.3% of German GPs and practice assistants with no difference observed between those in solo and group practices.
Baker et al., 2018	Survey	Patients Physicians	The use of HIT, care management processes, and quality improvement processes increased over time, but only quality improvement processes were

			attributable to a larger group size. Additionally, no significant differences were seen in cost and quality between different group sizes.
Kwietniewski & Schreyögg, 2018	Survey	Physicians	Group practices of all sizes and most specialties have been shown to have more technical, cost, and profit efficiencies than solo practices and this was thought to be due to the standardization of processes.
Noroxe et al., 2018	Survey	Physicians	More than half of Danish GPs reported at least one burnout symptom. Those in group practices were less likely to report a poor work-life balance compared to solo GPs.

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	4-5
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	5
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	6
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	6
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Supp App B
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	6-7
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	7
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	7

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	8 Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	8 Supp App A
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	8-14 Supp App A
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	8-14
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	15-17
Limitations	20	Discuss the limitations of the scoping review process.	18
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	18-19
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	19

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

BMJ Open

Group Practice Impacts on Patients, Physicians, and Healthcare Systems: A Scoping Review

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-041579.R2
Article Type:	Original research
Date Submitted by the Author:	13-Dec-2020
Complete List of Authors:	Zwiep, Terry; Western University, Surgery Ahn, San (Hilalion); The Ottawa Hospital, Surgery Brehaut, Jamie; Ottawa Hospital Research Institute, Clinical Epidemiology Program Balaa, Fady; The Ottawa Hospital McIsaac, Daniel; The Ottawa Hospital, Anesthesiology and Pain Medicine Rich, Susan; The Ottawa Hospital Wallace, Tom; The Ottawa Hospital, Surgery Moloo, Husein; The Ottawa Hospital, Surgical Oncology; The Ottawa Hospital Research Institute , Clinical Epidemiology Program
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Medical management, Health policy
Keywords:	HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisation of health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Group Practice Impacts on Patients, Physicians, and Healthcare Systems: A Scoping Review

Terry M Zwiep, Western University, London, Ontario, Canada
San (Hilalion) Ahn, The Ottawa Hospital, Ottawa, Ontario, Canada
Jamie Brehaut, Ottawa Hospital Research Institute, Ottawa, Ontario, Canada
Fady Balaa, The Ottawa Hospital, Ottawa, Ontario, Canada
Daniel I McIsaac, The Ottawa Hospital, Ottawa, Ontario, Canada
Susan Rich, The Ottawa Hospital, Ottawa, Ontario, Canada
Tom Wallace, The Ottawa Hospital, Ottawa, Ontario, Canada
Husein Moloo, The Ottawa Hospital, Ottawa, Ontario, Canada

Corresponding Author: Terry Zwiep
Western University
E2-211, 800 Commissioners Rd. E.
London, ON, N6A 5W9
Phone: (519) 685-8260
Fax: (519) 685-8378
terry.zwiep@lhsc.on.ca

ABSTRACT

Objective: To identify the advantages and disadvantages that group practices have on patients, physicians, and healthcare systems.

Study design: A scoping review was performed based on the methodology proposed by Arksey and O'Malley, and refined by Levac and colleagues. Titles and abstracts were screened by two reviewers. A quantitative analysis was performed to assess the type, year, and region of publication as well as the population studied. A qualitative descriptive analysis was performed to identify common themes.

Study setting: MEDLINE, EMBASE, and Cochrane databases were searched from database inception to October 2018 for papers which assessed outcomes relevant to the research question.

Results: Our search strategy returned 2408 papers and 98 were included in the final analysis. Most papers were from the United States, were surveys, and assessed physician outcomes. Advantages of group practices for patients included improved satisfaction and quality of care. Studies of physicians reported improved quality of life and income, while disadvantages included increased stress due to poor interpersonal relationships. Studies of healthcare systems reported improved efficiency and better utilization of resources.

Conclusions: Group practices have many benefits for patients and physicians. However, further work needs to be done assessing patient outcomes and establishing the elements that make a group practice successful.

Strengths and limitations of this study:

- This was a large, comprehensive overview of group practices from many countries
- The scoping review methodology allowed us to assess a wide variety of papers and identify key gaps in the knowledge for further study
- Patient engagement was instrumental on focusing this review on patient outcomes and areas for improvement
- This review was limited by language restrictions, heterogeneity of the data, and possible publication bias

INTRODUCTION

Group practices have existed for over 100 years with one of the first groups set up by the Mayo brothers in the mid-1880s[1]. This group was eventually transformed into a large organization that has been recognized as a center of excellence leading to benefits for patients and physicians. Following their success, group practices became more and more common, and currently, many physicians around world are practicing within groups or partnerships[2–5]. Sizes of group practices vary dramatically, from 2 physicians to over 100 physicians, and there is no standard definition of what defines a group. Over the years many papers have been published on group practice formation assessing various advantages and disadvantages for patients, physicians, and healthcare systems as well as the impetus behind their development. The economic benefits of these groups and the improvements in service provision to patients is supported by the literature and has been well documented[3,6–8]. Barriers to the formation of group practices, or conflicts that can result from group practices have also been considered and often have to do with interpersonal relationships[9–12]. The extent of literature spans many decades and provides an excellent overview of how group practices have evolved and the effects which they have had on patients, physicians, and healthcare systems.

Patient care can be significantly altered by the formation of group practices, and it is important to consider this impact as groups are often formed for reasons that are not directly related to patient care[11,13–15]. Some of these other reasons include the benefits realized by physicians with regards to income, quality of life, satisfaction, and decreased physician burnout, which is estimated to affect more than half of physicians [9,16–19]. Group practices also may be developed due to healthcare system incentives, or as a way to improve the income and efficiency of physicians within a given system[14,20–23]. This again may not be directly related to patient care

but may have impacts on the quality of care and its timeliness. Whatever the motivation for forming group practices, it is important to assess the effects on all involved stakeholders to ensure that this is a step in the right direction for the patients that healthcare providers are committed to serve, the wellbeing of physicians, and the sustainability of the systems which healthcare providers work within.

There has been a paucity of literature that synthesizes the knowledge published regarding group practices. A systematic review published in 2013 assessed the effectiveness of group versus solo practice amongst general practitioners (GPs) and demonstrated a positive association between group practices and clinical processes, physicians opinions, and innovation, but did not observe any effect for patient measures[7]. A recent review has also attempted to establish a definition for group practices and the overall shift towards their development[24]. The objectives of this study were to review the literature for evidence that assesses the advantages and disadvantages that group practices have on patients with regards to quality of care and satisfaction; physicians with regards to team dynamics, income, and satisfaction; and the financial impact on healthcare systems. A scoping review was performed as we expected to identify heterogenous studies with a wide range of outcomes focused on patients, physicians, and healthcare systems. A broad overview of the literature was desired to identify current knowledge gaps and guide further studies.

METHODOLOGY

A scoping review was performed according to the methodology proposed by Arksey and O'Malley, and refined by Levac and colleagues[25,26]. The PRISMA extension for scoping reviews (PRISMA-ScR) checklist was used to ensure all relevant aspects of a scoping review were included[27]. The following research question was developed:

What advantages and disadvantages do group practices have for patients, physicians, and healthcare systems?

A complete scoping review protocol was developed and published[28]. The following stages were incorporated into this scoping review according to what is suggested by Levac et al.: identifying the research question; identifying relevant studies; study selection; charting the data; collating, summarizing, and reporting results; and consultation. Full details on each stage can be found in the published protocol[28]. Briefly, MEDLINE, EMBASE and Cochrane Central were searched from database inception to October 2018 to identify relevant studies that assess the impact of group practices on patient care, satisfaction, and outcomes; physician quality of life, satisfaction, and income; and healthcare system finances. There were no restrictions placed on publication date. The grey literature was not searched as originally indicated in the protocol due to an adequate number of peer-reviewed articles which met inclusion criteria from the databases. The search strategy was peer reviewed according to the formal process outlined by McGowan et al[29]. The search strategy is included in Appendix A.

Three members of the research team met to perform a calibration exercise and review 10 papers to pilot the screening and full text data extraction forms. Titles and abstracts were subsequently screened independently by two reviewers and the abstraction results from the full text articles were charted and verified by the same two members. Disagreements were resolved by discussion between the two reviewers as well as input from other authors of the paper. We included papers that:

- Included patients receiving, and/or clinicians providing care within any type of group practice (Population)

- Assessed the advantages and/or disadvantages of group practices (Concept)

We examined all papers from group practices in all areas of medicine which reported outcomes relevant to patients, clinicians, or health system stakeholders (Context).

Papers were excluded if they were not published in the English language.

DistillerSR (Evidence Partners, Ottawa, Canada) was used for screening and data extraction. A standardized form was created and tested on 10 papers by three members of the research team. We did not deviate from the protocol and charted authors, year of publication, country of origin, objectives, type and size of group practice, population studied (patients, physicians, etc.), sample size, methods and type of study, interventions, outcomes, and key findings[28]. This standardized form was used throughout the study and no changes were required after it was tested.We extracted and summarized included paper characteristics including type of study, year, region of publication, and the population studied. A qualitative analysis was also performed using a qualitative descriptive approach from the key findings of the selected papers[30]. A coding manual was created and codes were applied to the key findings. These were refined as the study progressed and grouped into themes. This was performed in parallel by two reviewers who then met to discuss the results and corresponding themes. After a conventional content analysis, common themes were grouped by:

1) patient care, including satisfaction and quality of care

2) physicians, including quality of life, competency, group dynamics, group characteristics, and financial impacts

3) healthcare system issues relating to financial impacts

A detailed quality assessment was not performed due to the heterogeneity of the data and the general principles of a scoping review[26]. During the scoping review process, we consulted with four surgeons from other group practices to ensure that the review was comprehensive and

that all relevant papers were included. These surgeons were known by the research group to be participants in group practices.

Patient and Public Involvement

A patient advisor was recruited from the Department of Patient Relations as part of the research team. As practice organization directly impacts on patients, it was essential that we had patient input into the design of the study and the analysis of the data. The patient advisor collaborated with the team and ensured that the research question and outcomes were applicable to patients and reviewed the final draft of the paper[31].

RESULTS

Using the search strategy outlined in Supplementary Appendix A, 2408 papers were identified. Of these, 35 were excluded as duplicates and 2373 titles and abstracts were screened. After screening, 149 full text articles were examined and 98 met inclusion criteria. Of those excluded, 34 did not assess advantages or disadvantages of group practices, 5 papers focused on multidisciplinary groups, 2 papers were based on a previous paper and did not provide any new data, and 1 paper assessed a dental group practice. We were unable to obtain full text articles for 9 papers. The PRISMA flow diagram in Figure 1 displays these results.

The majority of papers were from the United States (58%), followed by Europe (19%), and then Canada (15%). There were only a handful of papers from elsewhere in the world (7%). Papers frequently included more than one type of group practice. Family medicine was reported on most commonly (76%), followed by surgical practices (43%), and all others (36%). Physicians (94%) were the focus of almost all the papers rather than patients (26%), allied health (4%), or healthcare systems (10%). Some papers touched on multiple populations. Most of the

included papers were surveys (63%). Group practices have been published on dating back until at least the 1960s. Recurring themes were evident over the years and are expanded on in the qualitative analysis. See Table 1 for a full description of included papers.

Table 1 - Selected Paper Characteristics

Characteristic		n (%)
Region of Study	United States	56 (57%)
	Europe	20 (20%)
	Canada	16 (16%)
	Other	7 (7%)
Type of Group Practice	Family Medicine or General Practitioner	74 (76%)
	Surgical	42 (43%)
	Other	35 (36%)
Population Studied	Physicians	92 (94%)
	Patients	25 (26%)
	Healthcare Systems	10 (10%)
	Allied Health	4 (4%)

Type of Publication	Survey	62 (63%)
	Letter	7 (7%)
	Case Report	6 (6%)
	Cohort Study	5 (5%)
	Abstract	2 (2%)
	Case Series	2 (2%)
	RCT	2 (2%)
	Systematic Review	2 (2%)
	Other	10 (10%)
Publications by Decade	1960-1969	6 (6%)
	1970-1979	9 (9%)
	1980-1989	5 (5%)
	1990-1999	9 (9%)
	2000-2009	23 (23%)
	2010-present	46 (49%)

Group Practices Improve Patient Satisfaction and Experience

Sources that addressed patient outcomes are listed in Supplementary Appendix B. Six of these provided evidence that group practices can result in improvements in patient satisfaction[23,32–35]. Four of these sources were surveys that assessed changes in satisfaction after the implementation or expansion of a group practice. This sense of satisfaction appeared to be most commonly due to better perceived access to care and quality of care. In contrast to this, one survey from 1975 identified a negative effect on patient satisfaction and experience[36]. The Patient Perceptions of Integrated Care survey identified that patients with multiple chronic diseases who perceive a higher level of integration within a group will utilize less emergency department and outpatient resources[37].

Patient Quality of Care

The aspects of quality of care assessed by the papers included access to care, continuity of care, prescribing techniques, adherence of the physicians with established clinical guidelines, frequency of consultations, and unnecessary investigations and treatment. Twenty-two sources either identified an improvement in patient quality of care associated with group practices or a negative impact on patient quality of care. Two sources did not identify any differences in patient quality of care based on practice organization[38,39].

Group Practices Improve Patient Quality of Care

Twenty-two sources demonstrated improvements in patient quality of care. This included objective measures with quality of care scores as well as patient perception as captured by surveys. Group practices were found to improve access to care, comprehensiveness, waiting times, time spent with patients, efficiency, patient safety, and utilization of resources according to patient reported outcomes[6,8,33,40–48]. Patients perceived a higher quality of care with group

practices with regards to tangibles (equipment and facilities), reliability, responsiveness, assurance, and empathy[49]. Physicians in group practices had higher quality of care scores and adherence to guidelines was found to be better due to increased knowledge sharing and access to information[35,44,50,51]. Improvements in appropriate prescribing techniques were also associated with physicians working in group practices[7,52]. Physicians in group practices were also more likely to consult peers[53]. More patient-centered medical home processes within a practice were associated with larger groups compared to solo and small group practices (1-2 physicians), although all types of practices have shown modest increases over time[54,55]. However, a recent paper based on large surveys found no improvements in quality measures based on practice size[56].

Group Practices Negatively Impact Patient Quality of Care

Six sources noted some negative impacts with group practices on patient quality of care. This included worse continuity of care and dilution of the patient-doctor relationship[41,57]. Group practices have also been found to order more investigations or treat inappropriately if there was a financial benefit[8,58,59]. Additionally, a primary care internist who moved from a small practice to a large group practice after many years perceived that the level of care he was providing was compromised by the large group and payers setting targets for the group[60].

Physician Quality of Life, Satisfaction, and Burnout

Papers which assessed physician outcomes are listed in Supplementary Appendix B. Twenty papers assessed the relationship between group practices and physician quality of life, satisfaction, and burnout. Two papers did not find any significant difference in this area for group and solo practices[61,62]. Two main themes were identified from the sources including the

following: group practices improve physician quality of life and satisfaction, and group practices lead to conflict and additional stress for physicians.

Group Practices Improve Physician Quality of Life and Satisfaction

Group practices were often found to improve the work-life balance and job satisfaction of physicians when compared to solo practices[9,19,63–67]. Being a member of a group practice led to less professional isolation, improved knowledge sharing, and an improvement in professional development[9,19,68]. Improved attitudes about group practices in the Netherlands were related to an increased desire for contact and cooperation with other physicians[69]. Satisfaction with personal and lifestyle factors and optimism for the future was increased amongst physicians in group practices[70,71]. Group practices were also associated with a decreased call burden and increased cross coverage of patients which directly impacts the quality of life for most physicians and their families[6,68]. Due to the aforementioned benefits, group practices have also been noted to improve retention and recruitment initiatives, especially in rural or underserviced areas[68,72].

Group Practices Lead to Conflict and Additional Stress for Physicians

Seven sources have identified issues with group practices that create conflict and additional stress for physicians. These center around the interpersonal relationships of the group members and sustainability[63]. Poor interpersonal relationships lead to lower job satisfaction and a higher degree of professional burnout[73,74]. Three papers identified that group practices were also associated with increased physician demands, decreased performance, and reduced autonomy[74–76]. A large survey of family physicians in Canada found that physicians in solo practice had more job satisfaction than those in group practices in a survey that was primarily assessing improved satisfaction with performing procedures[77].

Group Practices Improve Physician Competency

Two papers addressed differences in physician competency[78,79]. Family physicians and surgeons were found to be less likely to pass their respective maintenance of certification exams if they were in a solo practice. This was thought to result from the ability to spend more time on quality improvement and education within a group practice.

Facilitators and Barriers Associated with Working in a Group Practice

An important theme that arose during analysis was the identification of barriers and facilitators associated with forming or maintaining a group practice. These characteristics have direct impacts on patient care and physician quality of life, job satisfaction, and burnout. Eight sources identified these characteristics and they are summarized in Table 2[10,12,22,80–84].

Table 2 - List of Barriers and Facilitators for Group Practices

Facilitators	Barriers
Teamwork[81,82]	Incompatible personalities[10,22]
Leadership[22,81]	Poor leadership[12]
Common vision[84]	Different visions for the group[12]
Patient centred care[81]	Disagreements about re-imbursement[12]
Quality improvement[81]	Legal and real estate issues[10]
Accountability[81]	Dissatisfied office staff[12]
Sense of ownership[81]	Fears about loss of autonomy[80]
Sense of responsibility[82]	
Cohesiveness[82,83]	

Group Practices Lead to Higher Incomes for Physicians

Seven sources from the United States, Taiwan, and South Africa have identified increased individual earnings for physicians practicing within group practices[15,21,71,85–88]. Physicians in group practices have also been shown to be more satisfied with their compensation. A letter published in 1968 highlighted income deferral by physicians until later in life when they were less productive as an additional benefit of group practices[89]. Currently, larger groups may be forming in the United States as they are able to leverage insurers more effectively and build up more market share[3].

Costs of Group Practices are Higher than Solo Practices

Costs of group practices have been found to be higher than those of solo practices[20,90,91]. This may be due to more investment in technological costs that solo practices would not be able to afford[20,91]. Some large group practices may also be more inefficient than solo or small group practices[92].

Group Practices May Improve the Uptake of Health Information Technology

Physicians practicing in groups are more likely to have greater access to health information technology (HIT) and were also more likely to correspond with their patients and other providers via email[7,93]. Family physicians in the United States in solo practices were found to be less likely to adopt electronic health records when compared to those in group practices[94,95]. Data from two large surveys indicated a general trend towards increased use of HIT over time, but did not see a clear association between group size and an increased use of HIT[56].

More Physicians are Practicing in Group Practices and Group Practices are Increasing in Size

Many sources have tracked the rise in the number and type of group practices over the years (Supplementary Appendix B). The definition of a group practice is very heterogenous in

the literature and previous work has been done in an attempt to classify groups[24]. Often, groups of 1-19 physicians are classified as small or medium (further subclassified into groups of 1-2, 3-7, 8-12, and 13-19), and groups of 20 or more are classified as large (further subclassified into groups of 20-99 and >100).[54,55] The included papers show an increase in the absolute number of group practices and their sizes over the years.

In 1968, group practices were mostly limited to hospitals with most other physicians working in solo practices outside of the hospitals, and it was believed that group practices would not be taken up unless it was established as a desirable form of practice to society and health care professionals[96,97]. Now, in the United States, more physicians across all specialties are forming or joining larger groups and groups of more than 100 physicians which usually have non-physician owners, have grown rapidly in recent years[2–4]. This increase has been driven by the benefits group practices can offer physicians[11,13,98–101].

Despite having a very different healthcare system, group practices have also grown in Canada. In 1970, 57% of graduating physicians entered a group practice or partnership, 21% entered solo practice, and 22% became salaried physicians. Surgeons and psychiatrists were most likely to enter solo practice[5]. A survey of Canadian physicians in 1987 found that around half of the physicians were in either solo or group practices and the other half had some group practice arrangements for financial benefits[14]. Government support was seen as a key factor in establishing group practices[14,102].

Group Practices May Help Reduce Costs Within Healthcare Systems

Group practices have the potential to impact healthcare systems financially, with respect to access to care, and appropriate utilization of healthcare resources. Sources have shown that group practices of all sizes and most specialties have been shown to have more technical, cost,

and profit efficiencies than solo practices (Supplementary Appendix B)[103,104]. This is thought to be due to the standardization of processes[104]. Group practices that focus on improved screening and monitoring may improve avoidable utilization, cost, and revenue[103]. A higher level of integration perceived by patients with chronic illnesses also reduces utilization of emergency department and outpatient resources[37]. Income pooling within an obstetrical call group in a Canadian study led to decreased rates of elective induction of labour in a before and after study[105]. Older data from the Physicians' Practice Cost and Income Survey in 1986 found no significant differences in practice efficiency between solo and group primary care practices in the United States[106]. Additionally, a recent paper which included data from large surveys found that group size was not associated with an improvement in spending or quality[56].

DISCUSSION

We were able to identify themes associated with the advantages and disadvantages that group practices have for patients, physicians, and healthcare systems. It is important to note that the term 'group practice' refers to a broad range of practice types within the literature and there is no clear definition with respect to the critical pieces that define what a group practice is beyond the number of physicians and inclusion of one or more specialties. Organizations in the United States such as the America's Physician Groups, and American Medical Group Association have been developed to represent physicians in various types of groups. Groups may be defined as single specialty with two or more physicians or multispecialty with any number of different specialties providing care to patients.

Themes involving patients included satisfaction and quality of care. Generally, patients seemed to be more satisfied with care that was being received from physicians in group

practices[23,32,33,40]. From these studies, this appears to be due to increased access to care and decreased waiting times. Although continuity of care would seem to be a legitimate concern with a group practice as patients may be seeing different physicians on any given day, this was actually shown to be improved in one study[23]. Concerns surrounding continuity of care were raised in one study which addressed non-adherent patients in a group practice[57]. Furthermore, in a situation that is unique to a surgical group practice, patients did not seem to be concerned by the fact that they might not meet the surgeon who is operating on them until the day of their operation as they had confidence in any of the surgeons associated with the group[33].

While it is important that patients are satisfied with the care they are receiving, it is imperative that they also receive high quality care. Overall, most papers indicated that the quality of care increased with a group practice structure as measured objectively and subjectively. Adherence to guidelines and appropriate prescribing was better with group practices and quality of care scores improved[7,51,52]. There were some notable exceptions including using radiation therapy for prostate cancer when it was not necessarily indicated because the group owned radiation facilities, and the increased use of laboratory investigations offered by the group[15,58,59]. This may have been driven by convenience as well as financial gain.

Overall, patients appear to benefit from group practices through improved quality of care, access, and satisfaction. The data surrounding the impact of group practices on patients was presented in 24% of papers. This has been identified as an area for further research as we know that group practices are often formed to primarily benefit the physicians working within them[6,68,72].

Numerous advantages of group practices for physicians have been identified from this scoping review. They include increased quality of life and satisfaction, decreased burnout, higher

competency, and financial gain. More attention has been paid to physician burnout in recent years as the prevalence is surprisingly high[17,18]. Improving the quality of life and job satisfaction for physicians may help with this and group practices have the potential to help in these areas. Overall, most of the literature included in this review shows a positive association with group practices and physician quality of life and job satisfaction. These improvements result from a better work-life balance, shared call responsibilities, improved knowledge transfer, collaboration, and decreased professional isolation[6,9,63,66]. Physicians in solo practices may still be able to pursue similar opportunities but may face logistical challenges due to isolation.

A notable area of decreased satisfaction results from poor interpersonal relationships[12,22]. This can lead to the collapse of a group and highlights the need for group practice members to be compatible and share a common vision, especially if they are financially integrated. As groups become larger and larger, especially in the United States where groups of more than 100 physicians are not uncommon, relationships can become less collegial and autonomy may be lost[80]. The importance of regular meetings with a shared sense of ownership and responsibility has been shown to be very important to group function and quality of care[81,84]. Therefore, although groups have the potential to improve job satisfaction and quality of life for physicians, it depends on the overall functioning of the group and compatible personalities within the group for this to be achieved.

In the two papers assessing the level of physician competency (based on whether or not physicians were members of group practices) the overall impact seems to be positive with improved scores on certification exams[78,79]. This is thought to be due to more knowledge transfer between group members and less professional isolation. The ability to approach and consult

colleagues relatively easily about difficult or interesting clinical questions has the potential to enhance the learning of all group members and improve patient care.

Financially, group practices have been shown to improve incomes of physicians. This is most relevant in the United States where groups are often formed to gain negotiating leverage with payers[11,13]. However, individual incomes also seem to be higher in other areas of the world such as New Zealand, South Africa, and Taiwan[71,86,87]. The increased income may help offset costs associated with investments in equipment or technology that would not be feasible for solo physicians.

The impact of group practices on healthcare systems can be seen in improvements in access to care, system efficiencies, improved use of resources, and adherence to guidelines. Some exceptions to this may include inappropriate use of resources if there is a financial gain. Moving forward, this will be an important area of study as there are many different health care systems in place around the world.

This scoping review has allowed us to identify gaps in the literature which can be addressed in the future. As demonstrated above, patient care is often not the focus of research into group practices. This needs to be addressed to ensure that we are improving the service that is being delivered to the end user, namely, the patient. Creating a shared or group practice is often beneficial to physicians, but if the patient experience or quality of care is negatively impacted, this needs to be understood. Additionally, it was difficult to separate different types of group practices in the literature. The definition of a group practice varies significantly and includes anywhere from 2 to >100 physicians and/or allied health care providers[24]. This makes comparisons difficult. However, this scoping review has allowed us to perform a high level overview of all types of group practices and in an attempt to identify all characteristics which are

important to patients and physicians. The knowledge gaps we identified with respect to this issue includes a group practice definition and which elements contribute to a successful practice which benefits patients and physicians.

As part of the scoping review process, key stakeholders were consulted regarding this review. They included a patient advisor and members of other group practices. The patient advisor was included in the design of this study, verified the results, and reviewed the final draft of this manuscript. Other group practice members verified the results by reviewing the themes and included references, ensuring that all relevant papers were included. The patient advisor and group practice members will help to guide further research in the future. Some of the authors of this paper are group practice members and will be using their practice for research that will focus on patient outcomes including quality of care and satisfaction, as well as physician outcomes including quality of life, satisfaction, and burnout with guidance from this scoping review.

There are inherent limitations with a scoping review. This was meant to be a broad overview of the available literature and as such, the data are heterogenous and does not lend itself well to a quality assessment. There may very well be a publication bias with this topic as authors may only be inclined to publish on group practices that have worked very well. We were unable to obtain the full text for 9 papers. The included papers were also from many different regions and therefore, the conclusions may not be applicable to a particular country or region, however the objective of this review was to assess the advantages and disadvantages of group practices and common themes were identified that likely transcend many regional differences.

CONCLUSION

A group practice structure has many advantages for patients and physicians alike. Although the data is somewhat limited for patients compared to physicians, this scoping review

has shown that there is a generally positive patient experience with some evidence of improved quality of care. There is also an increase in physician satisfaction and quality of life in groups that function well with compatible personalities. This scoping review has summarized the available literature based on our research question and has allowed us to identify two interesting areas of future investigation. First, it will be important to define exactly what the critical elements of a group practice are beyond the number of physicians as there is no standard definition that we were able to discern in this scoping review. This may then be used to guide the development of functional groups that are able to improve care and quality of life for both patients and providers. Second, although most of the available literature is directed towards the impact of group practices on physicians, addressing patient outcomes and perspectives is essential. This has been addressed in the literature more recently, and is an area which should be further developed.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

ACKNOWLEDGEMENTS

We would like to acknowledge Risa Shorr and Josée Skuce for their help in developing the search strategy and obtaining full texts articles for this scoping review.

DATA AVAILABILITY STATEMENT

All data used are included in the article and supplementary appendices.

CONTRIBUTORS

HM, TZ, DM, and FB conceived the study. TZ and HM drafted the protocol and developed the research question. TZ and SA performed the title and abstract screening and full text data extraction. TZ, HM, JB, TW, and SR contributed to the thematic analysis and interpretation of the data. All authors read and approved the final manuscript. HM is the guarantor.

FIGURE LEGEND

Figure 1 - PRISMA flow diagram for screened and included papers.

REFERENCES

1. W. Bruce Fye WB. Presidential Address: The Origins and Evolution of the Mayo Clinic from 1864 to 1939: A Minnesota Family Practice Becomes an International "Medical Mecca"; *Bull Hist Med*. 2010;84(3):323-357.

2. Muhlestein DB, Smith NJ. Physician Consolidation: Rapid Movement From Small To Large Group Practices, 2013-15. *Health Aff (Millwood)*. 2016;35(9):1638-1642.

3. Burns LR, Goldsmith JC, Sen A. Horizontal and vertical integration of physicians: a tale of two tails. *Adv Health Care Manag*. 2013;15:39-117.

4. Liebhaber A, Grossman JM. Physicians moving to mid-sized, single-specialty practices. *Track Rep*. 2007;(18):1-5.

5. Paulick JM, Roos NP. The young physician: types of practice. *Can Med Assoc J*. 1978;118(3):276-278.

6. Breon TA. Rural Surgical Practice: An Iowa Group Model. *Surg Clin North Am*. 2009;89(6):1359-1366.

7. Damiani G, Silvestrini G, Federico B, et al. A systematic review on the effectiveness of group versus single-handed practice. *Health Policy*. 2013;113(1-2):180-187.

8. Devlin RA, Hogg W, Zhong J, Shortt M, Dahrouge S, Russell G. Practice size, financial sharing and quality of care. *BMC Health Serv Res*. 2013;13(1):446.

9. Feron J-M, Cerexhe F, Pestiaux D, et al. GPs working in solo practice: obstacles and motivations for working in a group? A qualitative study. *Fam Pract*. 2003;20(2):167-172.

10. Hays RB, Sanderson L. Forming large group practices: is it worth it? *Med J Aust*.

1994;161(8):494-496.

11. Casalino LP, Devers KJ, Lake TK, Reed M, Stoddard JJ. Benefits of and Barriers to Large Medical Group Practice in the United States. *Arch Intern Med*. 2003;163(16):1958.

12. Crane HS, Dennis DA. Risks of a large group practice: a personal experience. *Clin Orthop Relat Res*. 2003;(407):67-70.

13. Casalino LP, Pham H, Bazzoli G. Growth Of Single-Specialty Medical Groups. *Health Aff*. 2004;23(2):82-90.

14. Williams AP, Vayda E, Stevenson HM, Burke M, Pierre KD. A typology of medical practice organization in Canada. Data from a national survey of physicians. *Med Care*. 1990;28(11):995-1004.

15. Bailey RM. A comparison of internists in solo and fee-for-service group practice in the San Francisco Bay area. *Bull N Y Acad Med*. 1968;44(11):1293-1303.

16. Rothenberger DA. Physician Burnout and Well-Being: A Systematic Review and Framework for Action. *Dis Colon Rectum*. 2017;60(6):567-576.

17. West CP, Dyrbye LN, Erwin PJ, Shanafelt TD. Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis. *Lancet*. 2016;388(10057):2272-2281.

18. Shanafelt TD, Hasan O, Dyrbye LN, et al. Changes in Burnout and Satisfaction With Work-Life Balance in Physicians and the General US Working Population Between 2011 and 2014. *Mayo Clin Proc*. 2015;90(12):1600-1613.

19. Romano M. United we do quite well, thank you. Survey: physicians say practicing in

groups is a better way to provide care. *Mod Healthc*. 2001;31(12):34.

20. Heimeshoff M, Schreyögg J, Kwietniewski L. Cost and technical efficiency of physician practices: a stochastic frontier approach using panel data. *Health Care Manag Sci*. 2014;17(2):150-161.

21. Kwietniewski L, Schreyögg J. Profit efficiency of physician practices: a stochastic frontier approach using panel data. *Health Care Manag Sci*. 2018;21(1):76-86.

22. Rodríguez C, Pozzebon M. The implementation evaluation of primary care groups of practice: a focus on organizational identity. *BMC Fam Pract*. 2010;11(1):15.

23. Tourigny A, Aubin M, Haggerty J, et al. Patients' perceptions of the quality of care after primary care reform: Family medicine groups in Quebec. *Can Fam Physician*. 2010;56(7):e273-82.

24. Kash B, Tan D. Physician Group Practice Trends : A Comprehensive Review. *J Hosp Med Manag*. 2016;2(1:3):1-8.

25. Arksey H, O'Malley L. Scoping studies: Towards a methodological framework. *Int J Soc Res Methodol Theory Pract*. 2005;8(1):19-32.

26. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci*. 2010;5(1):69.

27. Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2018;169(7):467-473.

28. Zwiep TM, Greenberg JA, Balaa F, et al. Impact of group practices on patients, physicians and healthcare systems: protocol for a scoping review. *BMJ Open*. 2018;8(9):e022164.

29. McGowan J, Sampson M, Salzwedel DM, Cogo E, Foerster V, Lefebvre C. PRESS Peer Review of Electronic Search Strategies: 2015 Guideline Statement. *J Clin Epidemiol*. 2016;75:40-46.

30. Colorafi KJ, Evans B. Qualitative Descriptive Methods in Health Science Research. *HERD Heal Environ Res Des J*. 2016;9(4):16-25.

31. Core Values, Ethics, Spectrum – The 3 Pillars of Public Participation - International Association for Public Participation. https://www.iap2.org/page/pillars. Accessed November 16, 2020.

32. Gawande SR, Benroth R. Comparison of patient satisfaction results during a period of rapid growth for a specialty group practice. *Am J Orthop (Belle Mead NJ)*. 1999;28(4):236-238.

33. van den Heuvel B, Vair B, Porter G, Klassen D, Inglis K, Bonjer HJ. Patient compliance with a group model of care: the hernia clinic. *Can J Surg*. 2012;55(4):259-263.

34. Cohidon C, Wild P, Senn N. Patient experience in primary care: association with patient, physician and practice characteristics in a fee-for-service system. *Swiss Med Wkly*. 2018;148(1314):w14601.

35. Ellis SD, Karim SA, Vukas RR, Marx D, Uddin J. Four Needles in a Haystack: A Systematic Review Assessing Quality of Health Care in Specialty Practice by Practice Type. *Inquiry*. 2018;55:46958018787041.

36. Ritchey FJ. Solo and Group Physician Practices, Family-Physician Relationships and Unmet Critical Health Need in Rural Areas. In: *Annual Meeting of the Southwestern*

Sociological Association. San Antonio; 1975.

37. Fryer A-K, Friedberg MW, Thompson RW, Singer SJ. Patient perceptions of integrated care and their relationship to utilization of emergency, inpatient and outpatient services. *Healthcare*. 2017;5(4):183-193.

38. Visca M, Donatini A, Gini R, et al. Group versus single handed primary care: a performance evaluation of the care delivered to chronic patients by Italian GPs. *Health Policy*. 2013;113(1-2):188-198.

39. Roos NP. Impact of the organization of practice on quality of care and physician productivity. *Med Care*. 1980;18(4):347-359.

40. Cohen DI, Breslau D, Porter DK, et al. Academic group practice. The patient's perspective. *Med Care*. 1986;24(11):990-998.

41. Graham FE. Group versus solo practice: arguments and evidence. *Inquiry*. 1972;9(2):49-60.

42. Gaal S, van den Hombergh P, Verstappen W, Wensing M. Patient safety features are more present in larger primary care practices. *Health Policy (New York)*. 2010;97(1):87-91.

43. Xierali IM. Physician Multisite Practicing: Impact on Access to Care. *J Am Board Fam Med*. 2018;31(2):260-269.

44. Stol DM, Hollander M, Nielen MMJ, Badenbroek IF, Schellevis FG, de Wit NJ. Implementation of selective prevention for cardiometabolic diseases; are Dutch general practices adequately prepared? *Scand J Prim Health Care*. 2018;36(1):20-27.

45. Bardos J, Loudon H, Rekawek P, Friedman F, Brodman M, Fox N. The Association

between Solo versus Group Obstetrical Practice Model and Delivery Outcomes. *Am J Perinatol*. November 2018.

46. Ly DP, Glied SA. Variations in the service quality of medical practices. *Am J Manag Care*. 2013;19(11):e378-85.

47. Orrantia E. Marathon works. How to thrive in rural practice. *Can Fam Physician*. 2005;51:1217-1221.

48. Campbell JL, Ramsay J, Green J. Practice size: impact on consultation length, workload, and patient assessment of care. *Br J Gen Pract*. 2001;51(469):644-650.

49. Lin H-C, Xirasagar S, Laditka JN. Patient perceptions of service quality in group versus solo practice clinics. *Int J Qual Heal care J Int Soc Qual Heal Care*. 2004;16(6):437-445.

50. Perkins RB, Anderson BL, Gorin SS, Schulkin JA. Challenges in cervical cancer prevention: a survey of U.S. obstetrician-gynecologists. *Am J Prev Med*. 2013;45(2):175-181.

51. Ashworth M, Armstrong D. The relationship between general practice characteristics and quality of care: a national survey of quality indicators used in the UK Quality and Outcomes Framework, 2004-5. *BMC Fam Pract*. 2006;7(1):68.

52. Pichetti S, Sermet C, Godman B, Campbell SM, Gustafsson LL. Multilevel analysis of the influence of patients' and general practitioners' characteristics on patented versus multiple-sourced statin prescribing in France. *Appl Health Econ Health Policy*. 2013;11(3):205-218.

53. Kuyvenhoven MM, Pieters HM, Jacobs HM, Touw-Otten FW, Spreeuwenberg C. Do peer

consultations improve quality of care in general practice? *Qual Assur Heal care Off J Int Soc Qual Assur Heal Care*. 1990;2(2):171-179.

54. Rittenhouse DR, Casalino LP, Shortell SM, et al. Small and medium-size physician practices use few patient-centered medical home processes. *Health Aff (Millwood)*. 2011;30(8):1575-1584.

55. Wiley JA, Rittenhouse DR, Shortell SM, et al. Managing chronic illness: physician practices increased the use of care management and medical home processes. *Health Aff (Millwood)*. 2015;34(1):78-86.

56. Baker LC, Pesko M, Ramsay P, Casalino LP, Shortell SM. Are Changes in Medical Group Practice Characteristics Over Time Associated With Medicare Spending and Quality of Care? *Med Care Res Rev*. November 2018:107755871881293.

57. Freemyer B, Stoff B. Ethical challenges with treating nonadherent patients in a group practice setting. *J Am Acad Dermatol*. 2018;79(3):596-598.

58. Sellers EM. The influences of group and independent general practice on patient care: A comparative study in Ontario. *Can Med Assoc J*. 1965;93:147-157.

59. Hollenbeck BK, Kaufman SR, Yan P, et al. Urologist Practice Affiliation and Intensity-modulated Radiation Therapy for Prostate Cancer in the Elderly. *Eur Urol*. 2018;73(4):491-498.

60. Landon BE. Use of quality indicators in patient care: a senior primary care physician trying to take good care of his patients. *JAMA*. 2012;307(9):956-964.

61. Pasternak DP, Tuttle WC, Smith HL. Physician satisfaction in group practice: a

comparison of primary care physicians with specialists. *GHAA J*. 1986;7(1):50-59.

62. Viehmann A, Kersting C, Thielmann A, Weltermann B. Prevalence of chronic stress in general practitioners and practice assistants: Personal, practice and regional characteristics. De Socio GV, ed. *PLoS One*. 2017;12(5):e0176658.

63. Koppula S, Brown JB, Jordan JM. Experiences of Family Physicians Who Practise Primary Care Obstetrics in Groups. *J Obstet Gynaecol Canada*. 2011;33(2):121-126.

64. Hueston WJ. Family physicians' satisfaction with practice. *Arch Fam Med*. 1998;7(3):242-247.

65. Dowell AC, Hamilton S, McLeod DK. Job satisfaction, psychological morbidity and job stress among New Zealand general practitioners. *N Z Med J*. 2000;113(1113):269-272.

66. Streu R, Hawley S, Gay A, Salem B, Abrahamse P, Alderman AK. Satisfaction with Career Choice among U.S. Plastic Surgeons: Results from a National Survey. *Plast Reconstr Surg*. 2010;126(2):636-642.

67. Nørøxe KB, Pedersen AF, Bro F, Vedsted P. Mental well-being and job satisfaction among general practitioners: a nationwide cross-sectional survey in Denmark. *BMC Fam Pract*. 2018;19(1):130.

68. Connor RA, Hillson SD, Kralewski JE. An analysis of physician recruitment strategies in rural hospitals. *Health Care Manage Rev*. 1995;20(1):7-18.

69. Verbeek-Heida PM. General practitioners' attitudes towards group practice in the Netherlands. *Soc Sci Med*. 1969;3(2):249-258.

70. Stamps PL. Physicians and organizations: an uneasy alliance or a welcome relief? *J Fam*

Pract. 1995;41(1):27-32.

71. Moosa S, Luiz J, Carmichael T, Peersman W, Derese A. Insights of private general practitioners in group practice on the introduction of National Health Insurance in South Africa. *African J Prim Heal Care Fam Med*. 2016;8(1).

72. Evashwick CJ. The role of group practice in the distribution of physicians in nonmetropolitan areas. *Med Care*. 1976;14(10):808-823.

73. Streu R, Hansen J, Abrahamse P, Alderman AK. Professional burnout among US plastic surgeons: results of a national survey. *Ann Plast Surg*. 2014;72(3):346-350.

74. Orton P, Orton C, Pereira Gray D. Depersonalised doctors: a cross-sectional study of 564 doctors, 760 consultations and 1876 patient reports in UK general practice. *BMJ Open*. 2012;2(1):e000274.

75. Mahoney AR. Factors affecting physicians' choice of group or independent practice. *Inquiry*. 1973;10(2):9-18.

76. Mosaly PR, Mazur LM, Jones EL, et al. Quantifying the impact of cross coverage on physician's workload and performance in radiation oncology. *Pract Radiat Oncol*. 2013;3(4):e179-86.

77. Rivet C, Ryan B, Stewart M. Hands on: is there an association between doing procedures and job satisfaction? *Can Fam Physician*. 2007;53(1):93, 93:e.1-5, 92.

78. Schulte BM, Mannino DM, Royal KD, Brown SL, Peterson LE, Puffer JC. Community size and organization of practice predict family physician recertification success. *J Am Board Fam Med*. 2014;27(3):383-390.

79. Valentine MA, Barsade S, Edmondson AC, Gal A, Rhodes R. Informal Peer Interaction and Practice Type as Predictors of Physician Performance on Maintenance of Certification Examinations. *JAMA Surg*. 2014;149(6):597-603.

80. Curoe A, Kralewski J, Kaissi A. Assessing the cultures of medical group practices. *J Am Board Fam Pract*. 2003;16(5):394-398.

81. Solberg LI, Hroscikoski MC, Sperl-Hillen JM, Harper PG, Crabtree BF. Transforming medical care: case study of an exemplary, small medical group. *Ann Fam Med*. 2006;4(2):109-116.

82. Zazzali JL, Alexander JA, Shortell SM, Burns LR. Organizational Culture and Physician Satisfaction with Dimensions of Group Practice. *Health Serv Res*. 2007;42(3p1):1150-1176.

83. Masselink LE, Lee S-YD, Konrad TR. Workplace relational factors and physicians' intention to withdraw from practice. *Health Care Manage Rev*. 2008;33(2):178-187.

84. Suchman A, Mainali E, Hoffer Gittel J. Society of General Internal Medicine 34th Annual Meeting ABSTRACTS OF SUBMISSIONS. In: *ADDRESSING CHRONIC CONFLICT AND PROBLEMATIC BEHAVIORS IN A GROUP PRACTICE*. ; 2011:S556.

85. Lowes R. Group practices pay better. *Med Econ*. 2007;84(22):23-25.

86. Lin H-C, Chen C-S, Liu T-C, Lee H-C. Differences in practice income between solo and group practice physicians. *Health Policy (New York)*. 2006;79(2-3):296-305.

87. McCormick IR, Thomson AN. What future for solo general practice? *N Z Med J*. 1989;102(877):530-532.

88. Graham JW. Comparisons of solo practices and group practices. *J Oral Surg*. 1979;37 Spec No A:A65-82.

89. Rose I. Aspects of group medical practice. *Can Med Assoc J*. 1968;98(23):1118.

90. Davies S. General practice costs survey for financial year 1977/78. *N Z Med J*. 1979;90(639):20-23.

91. Kwietniewski L, Heimeshoff M, Schreyögg J. Estimation of a physician practice cost function. *Eur J Heal Econ*. 2017;18(4):481-494.

92. Kimbell LJ, Lorant JH. Physician productivity and returns to scale. *Health Serv Res*. 1977;12(4):367-379.

93. Mazurenko O, Hearld LR, Menachemi N. The relationship between the external environment and physician e-mail communication: The mediating role of health information technology availability. *Health Care Manage Rev*. 2017;42(2):122-131.

94. Xierali IM, Phillips RL, Green LA, Bazemore AW, Puffer JC. Factors influencing family physician adoption of electronic health records (EHRs). *J Am Board Fam Med*. 2013;26(4):388-393.

95. Rao SR, DesRoches CM, Donelan K, Campbell EG, Miralles PD, Jha AK. Electronic health records in small physician practices: availability, use, and perceived benefits. *J Am Med Informatics Assoc*. 2011;18(3):271-275.

96. Terris M. Introduction: Origins and growth of group practice. *Bull N Y Acad Med*. 1968;44(11):1277-1281.

97. Weinerman ER. Problems and perspectives of group practice. *Bull N Y Acad Med*.

1968;44(11):1423-1434.

98. Sturm R. Effect of managed care and financing on practice constraints and career satisfaction in primary care. *J Am Board Fam Pract*. 2002;15(5):367-377.

99. Sturm R. The impact of practice setting and financial incentives on career satisfaction and perceived practice limitations among surgeons. *Am J Surg*. 2002;183(3):222-225.

100. Holden DM. Rural practice modes. *Acad Med*. 1990;65(12 Suppl):S32-40.

101. Schryver DL, Niederman GA, Johnson BA. Establishing a group practice "without walls";. *Health Care Strateg Manage*. 1993;11(1):18-21.

102. Wallace JD. Group practice: the way of the future? *Can Med Assoc J*. 1974;111(6):571.

103. Kralewski J, Dowd B, Knutson D, Tong J, Savage M. The Relationships of Physician Practice Characteristics to Quality of Care and Costs. *Health Serv Res*. 2015;50(3):710-729.

104. Kwietniewski L, Schreyögg J. Efficiency of physician specialist groups. *Health Care Manag Sci*. 2018;21(3):409-425.

105. Bland ES, Oppenheimer LW, Holmes P, Wen SW. The effect of income pooling within a call group on rates of obstetric intervention. *CMAJ*. 2001;164(3):337-339.

106. Defelice LC, Bradford WD. Relative inefficiencies in production between solo and group practice physicians. *Health Econ*. 1997;6(5):455-465.

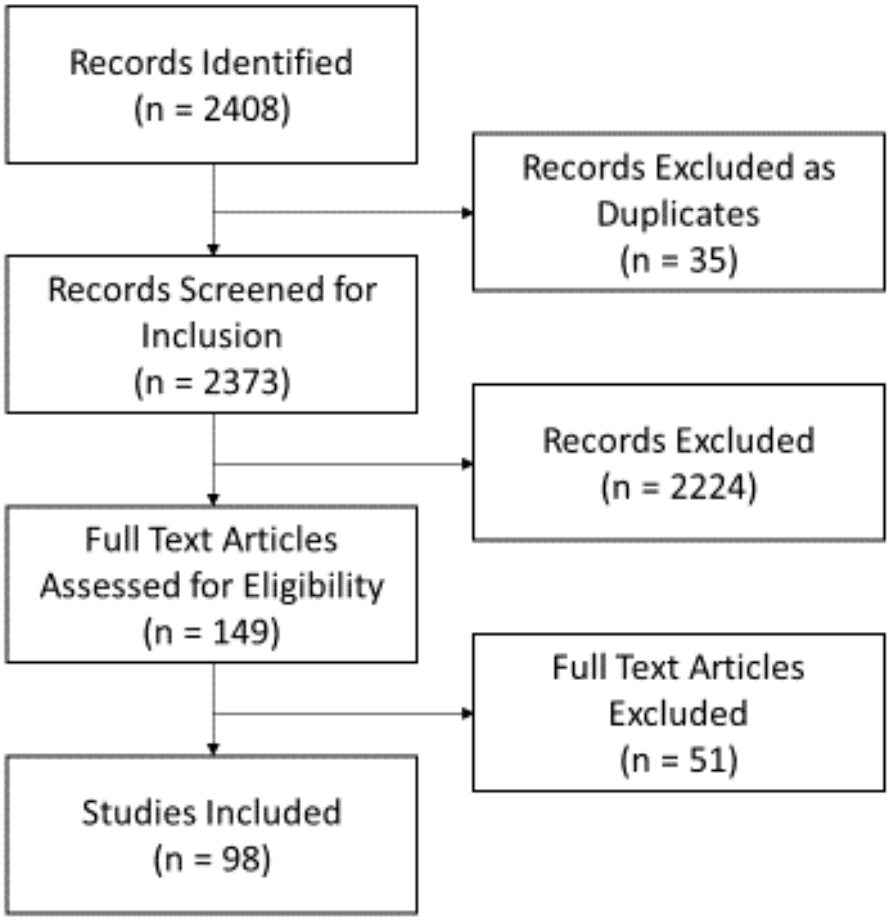

Figure 1 - PRISMA flow diagram for screened and included papers.

Database: Embase Classic+Embase <1947 to 2018 October 20>, Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Search Strategy:
---
1 Group Practice/ (16988)
2 (group practice* or group medical practice* or group model or group models).tw. (14652)
3 1 or 2 (26886)
4 physicians/ or allergists/ or anesthesiologists/ or cardiologists/ or dermatologists/ or endocrinologists/ or gastroenterologists/ or geriatricians/ or nephrologists/ or neurologists/ or oncologists/ or radiation oncologists/ or ophthalmologists/ or otolaryngologists/ or pediatricians/ or neonatologists/ or pulmonologists/ or radiologists/ or rheumatologists/ or surgeons/ or neurosurgeons/ or orthopedic surgeons/ (443392)
5 (allerg* or an?esthesiolog* or cardiolog* or clinician* or dermatolog* or endocrinolog* or gastroenterolog* or geriatrician* or gerontol* or gyn?ecolog* or h?ematolog* or nephrolog* or neurolog* or obstetric* or oncolog* or ophthalmolog* or otolaryngolog* or patholog* or p?ediatrician* or neonatolog* or physiatr* or pulmonolog* or orthop?ed* or radiolog* or rheumatolog* or surgeon* or neurosurgeon* or urolog* or general practitioner*).tw. (5716273)
6 general practitioners/ or physicians, family/ or physicians, primary care/ or Primary Health Care/ (224656)
7 (general practitioner* or family physician* or primary care physician*).tw. (170297)
8 physician*.ab. /freq=3 (121030)
9 or/4-8 (6177351)
10 3 and 9 (7625)
11 (group physician* or group surgeon*).tw. (683)
12 10 or 11 (8258)
13 income/ or exp pensions/ or remuneration/ or exp "salaries and fringe benefits"/ (144814)
14 prognosis/ or exp treatment outcome/ (3037613)
15 "Outcome Assessment (Health Care)"/ (306264)
16 personal satisfaction/ or job satisfaction/ (99372)
17 exp Patient Satisfaction/ (191942)
18 (satisfaction or patient reported outcome*).tw. (275754)
19 "Quality of Life"/ (522787)
20 "quality of health care"/ or quality assurance, health care/ (297926)
21 (income or salary).tw. (205853)
22 Life Style/ (134714)
23 life style.tw. (24521)
24 lifestyle.tw. (167173)
25 quality.mp. (2447101)
26 Stress, Psychological/ (166129)
27 Burnout, Professional/ (18655)
28 (burnout or stress).tw. (1383633)
29 perception of care.tw. (479)
30 models, organizational/ (62847)
31 organi?ation* model*.tw. (2367)
32 Physician-Patient Relations/ (177062)
33 (patient adj2 physician adj3 relation*).tw. (7804)
34 (revenue* or profit or profits).tw. (52523)
35 insurance, health, reimbursement/ or reimbursement mechanisms/ or reimbursement, incentive/ (73589)
36 or/13-35 (7492929)
37 12 and 36 (3422)
38 group practice*.ti,kw. or (group medical practice* or medical group practice*).tw,kw. (4213)
39 ("in data review" or in process or "pubmed not medline").st. (2785791)
40 38 and 39 (62)
41 37 or 40 (3481)

42 limit 41 to english language (3323)
43 42 use ppez (1607)
44 *group practice/ (11289)
45 (group practice* or group medical practice* or group model or group models).tw. (14652)
46 44 or 45 (22481)
47 *physician/ or *anesthesiologist/ or *cardiologist/ or *dermatologist/ or *emergency physician/ or *endocrinologist/ or *gastroenterologist/ or *general practitioner/ or *geriatrician/ or *gerontologist/ or *gynecologist/ or *hematologist/ or *hospital physician/ or *immunologist/ or *intensivist/ or *internist/ or *neonatologist/ or *nephrologist/ or *neurologist/ or *obstetrician/ or exp *oncologist/ or *ophthalmologist/ or *orthopedic specialist/ or *otolaryngologist/ or *pathologist/ or *pediatrician/ or *physiatrist/ or psychiatrist/ or *pulmonologist/ or exp *radiologist/ or *rheumatologist/ or exp *surgeon/ or *urologist/ (262673)
48 (allerg* or an?esthesiolog* or cardiolog* or clinician* or dermatolog* or endocrinolog* or gastroenterolog* or geriatrician* or gerontol* or gyn?ecolog* or h?ematolog* or nephrolog* or neurolog* or obstetric* or oncolog* or ophthalmolog* or otolaryngolog* or patholog* or p?ediatrician* or neonatolog* or physiatr* or pulmonolog* or orthop?ed* or radiolog* or rheumatolog* or surgeon* or neurosurgeon* or urolog* or general practitioner*).tw. (5716273)
49 (family physician* or primary care physician*).tw. (68204)
50 physician*.ab. (702496)
51 47 or 48 or 49 or 50 (6368299)
52 46 and 51 (6994)
53 (group physician* or group surgeon*).tw. (683)
54 52 or 53 (7627)
55 exp *"salary and fringe benefit"/ or *income/ (26491)
56 exp *treatment outcome/ (62134)
57 exp *"quality of life"/ (156501)
58 *health care quality/ (102682)
59 quality.tw. (1879375)
60 (income or salary).tw. (205853)
61 *lifestyle/ (32389)
62 (life style or lifestyle).tw. (189605)
63 *stress/ or *burnout/ (63482)
64 (burnout or stress).tw. (1383633)
65 "perception of care".tw. (479)
66 health care organization/ (123801)
67 organi?ation* model*.tw. (2367)
68 *doctor patient relation/ (68839)
69 (patient adj2 physician adj3 relation*).tw. (7804)
70 (revenue* or profit or profits).tw. (52523)
71 *reimbursement/ or *health insurance/ (81697)
72 *health care quality/ (102682)
73 *patient satisfaction/ (45768)
74 *satisfaction/ or *job satisfaction/ or *life satisfaction/ (37526)
75 satisfaction.tw. (253885)
76 patient reported outcome*.tw. (25479)
77 or/55-76 (4161152)
78 54 and 77 (2598)
79 limit 78 to english language (2485)
80 79 use emczd (1433)
81 conference abstract.pt. (2652420)
82 80 and 81 (152) Embase Conferences
83 80 not 82 (1281)
84 43 or 83 (2888)
85 remove duplicates from 84 (2105)
86 85 use ppez (1554) Medline
87 85 use emczd (551) Embase

Supplementary Appendix B

Table 1 - Papers Assessing Patient Outcomes

Author	Study Design	Population Studied	Key Findings
Sellers, 1965	Retrospective cohort study	Patients Physicians	More laboratory investigations and consultations for group practice patients and patients report more personal attention and in-depth explanations of a diagnosis and treatment by physicians in solo practices.
Graham, 1972	Review	Physicians	Limited evidence shows improvement in accessibility, continuity, quality, and efficiency with group practices. Potential drawbacks included dilution of the doctor-patient relationship and less autonomy.
Ritchey, 1975	Survey	Patients	Patients with solo GPs have better relationships with their physicians. Patients with GPs in group practice have greater unmet needs.
Roos, 1980	Retrospective Cohort study	Physicians	Quality of care and productivity were not found to be different for physicians in solo vs group practices in Manitoba.
Cohen et al., 1986	RCT	Patients Physicians Allied Health	Patients were randomized to a new group practice model and found no changes to patient satisfaction but there was a decrease in charges and utilization for patients as well as improved access to care, and decreased

			waiting times.
Kuyvenhoven et al., 1990	Survey	Patients Physicians	GPs in the Netherlands were surveyed and 20% of solo physicians stated that they never consulted their peers, while those working in a group practice did so regularly, which was found to help improve the level of attention paid to somatic complaints.
Gawande & Benroth, 1999	Survey	Patients Physicians	Patient satisfaction increased following the expansion of a group practice from 18 to 36 orthopedic surgeons in Indianapolis. This was felt to be due to decreased waiting times and increased time spent with a surgeon.
Campbell et al., 2001	Survey	Patients Physicians Healthcare Systems	Solo GP practices have shorter consultation lengths (15.2 min) vs group practices (17.8 min).
Lin et al., 2004	Survey	Patients	Patients perceive better overall quality of care in primary care group practices compared to solo practices with regards to equipment, facilities, reliability, responsiveness, assurance, and empathy.
Orrantia, 2005	Case Report	Patients Physicians	A family group practice that was established in Marathon, Ontario allowed for the maintenance of a stable number of physicians and also allowed for

			increased health care services offered to the community.
Ashworth & Armstrong, 2006	Survey	Patients Physicians	Group practices obtained significantly higher Quality and Outcomes Framework scores in the UK when compared to solo practices.
Breon, 2009	Case Report	Physicians Healthcare Systems	After the establishment of a surgical group practice in rural Iowa by five surgeons the access to surgical care at multiple hospitals improved and shared call coverage was achieved.
Gaal et al., 2010	Survey	Physicians	Larger primary care practices in Europe were found to have more patient safety features present, but clinical outcomes were not assessed in this paper.
Tourigny et al., 2010	Survey	Patients	Patient perception of continuity of care increased, accessibility remained the same, and physician co-ordination with specialists decreased in this before and after study following implementation of group practices in Quebec.
Weeks et al., 2010	Cross-sectional Study	Patients	Large multispecialty group practices enrolled with the Council of Accountable Physician Practices delivered better quality of care at a lower cost than other groups.
Rittenhouse	Survey	Patients	Larger groups used more patient-centered medical home processes than solo or

.136/bmjopen-2020-041578 on 8 January 2021. Downloaded from

et al., 2011			2 physician groups.
Landon, 2012	Conference	Healthcare Systems	A primary care internist who moved from a small practice to a large group practice after many years found that the level of care he was providing was compromised by the large group and payers setting targets for the group.
van den Heuvel et al., 2012	Survey	Patients	From a survey of patients seen in a group practice hernia clinic, most were found to be satisfied with any surgeon from the group performing their surgery, even if they hadn't met them until the day of surgery, and felt that the group practice allowed for more efficient use of resources.
Damiani et al., 2013	Systematic Review	Patients Physicians Healthcare Systems	GP group practices had positive impacts on prescribing appropriateness compared to solo practices. Other quality measures were found to have insufficient evidence in the included papers.
Devlin et al., 2013	Survey	Patients Physicians	Larger family physician group practices were associated with better access to care, comprehensiveness, and disease prevention. Continuity of care was negatively affected.
Ly & Glied, 2013	Survey	Patients Physicians	Large primary care group practices (> 10 physicians) in the United States were found to have shorter waiting times by 14 minutes for patients.

Mehrotra et al., 2013	Cross-sectional Study	Patients	Patients in integrated medical groups received higher quality care based on 6 quality measures compared to independent practice associations. The self-reported use of electronic medical records was higher as well.
Perkins et al., 2013	Survey	Physicians	Obstetricians and Gynecologists in the United States are more likely to adhere to established cervical cancer prevention guidelines if they are part of a group practice, possibly because of improved knowledge sharing and access to information.
Pichetti et al., 2013	Survey	Physicians	In France, those who work in groups were more likely to prescribe multiple sourced rather than patented statins than solo practitioners.
Visca et al., 2013	Survey	Patients Physicians	No clinically significant difference was found between solo and group practices in the management of chronic diseases by GPs.
Wiley et al., 2015	Survey	Patients Physicians	Processes for the patient-centered medical home model have increased in all group practices sizes over time but are only present in less than half of even large groups. Additionally, a reduction in patient involvement in care was noted over time.
Fryer et al.,	Survey	Patients	The Patient Perceptions of Integrated Care survey identified a decrease in

2017			utilization of emergency department and outpatient resources amongst patient with multiple chronic illnesses who perceived a higher level of integration in the group practice that delivered care to them.
Baker et al., 2018	Survey	Patients Physicians	No significant changes reported in quality measures based on group practice size.
Bardos et al., 2018	Cohort	Patients Physicians	Compared to those in groups, solo obstetricians had a higher Cesarean section rates but lower rates of shoulder dystocia and third or fourth degree tears which was felt to indicate that they had a more conservative approach to labour.
Cohidon et al., 2018	Survey	Patients Physicians	Patients in family physician group practices in Switzerland reported a better experience with continuity and co-ordination of care compared to solo practices. No differences were seen in their experience with access and communication between the practice types.
Ellis et al., 2018	Systematic review	Patients Physicians	In a limited number of studies, patients appeared to be more satisfied with specialist group practices rather than solo practices with respect to tangibles and their own assessment of quality.

Freemyer & Stoff, 2018	Case Report	Patients Physicians	In a group practice, there may be differing opinions and risk tolerance amongst members especially with non-adherent patients and potentially dangerous medications. In order to minimize the effect on continuity of care, physicians in group practices should develop policies around challenging situations and apply these consistently to patients.
Hollenbeck et al., 2018	Cohort	Patients Physicians	Prostate cancer patients were found to be more likely treated with intensity-modulated radiation therapy if the urology group owned radiation facilities regardless of group size even if the treatment was unlikely to be beneficial, suggesting that the financial incentive outweighed best practices in prostate cancer care and that group practices do not prevent conflicts of interest.
Stol et al., 2018	Survey	Physicians	Practices that implemented selective prevention for cardiometabolic diseases were more often group practices rather than solo practices. These practices were also organized better for chronic disease management.
Xierali, 2018	Cross-sectional study	Physicians	Physicians in group practices were more likely to practice at multiple sites which may increase the access to care for patients.

Table 2 – Papers Assessing Physician Outcomes

Author	Study Design	Population Studied	Key Findings
Bailey, 1968	Cohort	Patients Physicians	Physicians, rather than patients, benefit the most from multidisciplinary group practices as their output was lower, fees were higher, and they ordered more tests especially if that service was offered by the group.
Rose, 1968	Letter	Physicians	Income deferral by physicians until later in life when they were less productive was viewed as a benefit of group practices.
Terris, 1968	Letter	Physicians	Group practices were mostly limited to hospitals with most other physicians working in solo practices outside of the hospitals, and it was believed that group practices would not be taken up unless it was established as a desirable form of practice to society and health care professionals.
Weinerman, 1968	Letter	Patients Physicians	Group practices needed to be refocused on patients in order to be relevant to societal needs.
Verbeek-Heida, 1969	Survey	Physicians	A significant desire for contacts and co-operation with other general practitioners led to improved attitudes about group practices in the Netherlands.

Mahoney, 1973	Survey	Physicians	Future surgeons preferred solo practice due to the potential loss of autonomy while future obstetricians and pediatricians preferred practice partnerships, and future internists preferred group practices.
Wallace, 1974	Letter	Physicians	This letter from the secretary-general of the Canadian Medical Association highlighted the possible need for government support to help with the establishment of medical groups.
Evashwick, 1976	Cross-sectional Study	Physicians	Non-metropolitan areas in the United States that have a greater percentage of group practices have better retention and recruitment rates.
Kimbell & Lorant, 1977	Survey	Physicians	In 1979 in the United States, physician annual gross revenue, total patient visits per year, and office visits per year were measured and there were increasing returns to scale for physicians in solo or small group practice and inefficiencies noted in large group practices.
Paulick & Roos, 1978	Survey	Physicians	In Canada, 57% of graduating physicians entered a group practice or partnership, 21% entered solo practice, and 22% became salaried physicians. Surgeons and psychiatrists were most likely to enter solo practice.

Davies, 1979	Survey	Physicians	In 1978 in New Zealand, group practices had higher cost than solo practices.
Graham, 1979	Survey	Physicians	The Manpower Survey of Oral Surgery was performed and it was reported that oral surgeons working in group practices had higher incomes and employed fewer full-time equivalent staff per surgeon.
Pasternak et al., 1986	Survey	Physicians	There was no significant difference in physician satisfaction between those practicing in groups vs those in solo practice in the southwest United States.
McCormick & Thomson, 1989	Survey	Physicians	GPs in solo practice earn less than those in group practices (gross income 19% less) due to lower fees and lower numbers of patients seen.
Holden, 1990	Letter	Physicians	Solo family physician practice in rural areas was in decline and unlikely to succeed as group practices were forming and offering better benefits to graduating residents.
Williams et al., 1990	Survey	Physicians	Half of the physicians were in either solo or group practices and the other half had some group practice arrangements for financial benefits. They hypothesized that future formation of group practices would require some incentives from government, which has happened.

Schryver et al., 1993	Case Report	Physicians	A unique group practice without walls structure is described which allows for the formation of a group with physicians at different locations. The members enjoy the business and professional benefits of a group practice, but this still allows for autonomy, decentralization, and individual practice style.
Hays & Sanderson, 1994	Interviews	Physicians	GPs in Australia who were interested in forming group practices were completed and identified incompatible personalities or practice styles, legal and real estate issues, and initial costs as barriers.
Connor et al., 1995	Survey	Physicians Healthcare Systems	Group practice opportunities are an important aspect in recruiting physicians to practice in a rural hospital in order to reduce isolation, pool resources, and decrease call burden.
Stamps, 1995	Survey	Physicians	Physicians in private group practices were significantly more satisfied with personal and lifestyle factors than those in solo, hospital, or health maintenance organization related practices.
Defelice & Bradford, 1997	Survey	Physicians	Data from the Physicians' Practice Cost and Income Survey found no significant differences in practice efficiency between solo and group primary care practices in the United States.

Hueston, 1998	Survey	Physicians	GPs associated with solo or small group (≤3 physicians) practices were found to be less satisfied.
Dowell et al., 2000	Survey	Physicians	GPs associated with solo practices were found to be less satisfied than those in group practices.
Bland et al., 2001	Cohort	Patients Physicians	Income pooling within an obstetrical call group in a Canadian study led to decreased rates of elective induction of labour in a before and after study.
Romano, 2001	Letter	Physicians	Group practices generally enhanced United States physicians' quality of life, improved patient care, improved professional development, and led to higher earnings.
Sturm, 2002a	Survey	Physicians	Data from the Community Tracking Study was used to show that surgeons working within a small practice was the greatest predictor of career dissatisfaction and that patient quality of care was impacted by income pressures as well as decreased continuity of care and clinical freedom within solo or 2 surgeon practices.
Sturm, 2002b	Survey	Physicians	Data from the Community Tracking Study found that physicians working within a solo or 2 physician practice was the greatest predictor of career

			dissatisfaction. They also reported less clinical freedom and constraints on income.
Casalino et al., 2003	Survey	Physicians Healthcare systems	Data from the Community Tracking Study was also used to find that the most frequently cited reason for group practice formation was negotiating leverage, and barriers included lack of leadership, physician co-operation, and investment.
Crane & Dennis, 2003	Case Report	Physicians Healthcare systems	The growth and subsequent deterioration of a large orthopedic group practice which amalgamated multiple smaller groups is described. The eventual demise of the practice appeared to be due to poor leadership, disagreements over re-imbursement, differing visions for the future of the group, dissatisfied office staff who were in danger of being let go due to centralization, difficulty in negotiations with payers, and being undercut by smaller competing groups.
Curoe et al., 2003	Survey	Physicians	Physicians in the United States found that as group practice size increases, the culture is less collegial, less cohesive, and there is less organizational trust which was also true for multi-specialty practices compared to single specialty.

Feron et al., 2003	Survey	Physicians	Physicians working in solo practices viewed improved quality of life, knowledge sharing, and continuity of care as motivation to form a group practice. Interpersonal relationships, budget issues, loss of the patient-physician relationship, and differing views of the group were viewed as barriers.
Casalino et al., 2004	Survey	Physicians Healthcare systems	Data from the Community Tracking Study was used to assess the reasons for growth of group practices and it was seen that physicians were increasingly forming single specialty group practices to not only increase the scope of surgical services and diagnostic imaging they could offer, but also gain negotiating leverage with payers.
Lin et al., 2006	Survey	Physicians	In Taiwan, higher incomes were realized by physicians who were in single or multi-specialty groups when compared to solo practice physicians.
Solberg et al., 2006	Survey	Physicians	Within a family medicine group in the United States, categories important to a high level of care included teamwork, leadership, patient centered care, quality improvement, accountability, and a sense of ownership.
Liebhaber &	Letter	Physicians	From 1996/97 to 2004/05, the proportion of physicians in solo or 2 physician

Grossman, 2007			practices decreased from 40.7% to 32.5% and physicians were increasingly forming single specialty rather than multi-specialty group practices.
Lowes, 2007	Survey	Physicians	Primary care physicians in the United States were earning more money if they practiced within groups of more than 50 physicians.
Rivet et al., 2007	Survey	Physicians	Family physicians in solo practice had greater overall job satisfaction in this survey that primarily assessed improved satisfaction associated with performing procedures.
Zazzali, Alexander, Shortell, & Burns, 2007	Survey	Physicians	Stronger group culture emphasizing participation, teamwork, and cohesiveness promoted physician satisfaction. Conversely, a hierarchical structure had a negative effect on satisfaction.
Masselink, Lee, & Konrad, 2008	Survey	Physicians	Data from the Physician Worklife Survey found that good relationships with colleagues in a large group practice led to a decrease in a physician's intent to withdrawal from practice. A similar effect was not seen for physicians in small or solo practices.
Breon, 2009	Case Report	Physicians	After the establishment of a surgical group practice in rural Iowa by five

		Healthcare Systems	surgeons the access to surgical care at multiple hospitals improved and shared call coverage was achieved.
Rodríguez & Pozzebon, 2010	Case Study	Physicians Allied health Healthcare systems	A family medicine group in Quebec was assessed during its formation and difficulties with interpersonal and interprofessional relationships were identified and found to be quite detrimental to the functioning of the team. A new director was able to mend these relationships, improve communication, and move the group forward.
Streu et al., 2010	Survey	Physicians	Working within a group practice led to increased job satisfaction for plastic surgeons as they were less professionally isolated.
Koppula et al., 2011	Interviews	Physicians	Group practices allowed family physicians to have a better work-life balance, collaboration, and support from fellow group members and allowed for continuity of care during and beyond the obstetrical events. Some challenges identified included sustainability (securing locum physicians to cover absences) and conflict within the group.
Rao et al., 2011	Survey	Physicians	Family physicians in the United States in solo practices were found to be less likely to adopt electronic health records when compared to those in group

			practices.
Suchman A et al., 2011	Abstract	Physicians	Chronic conflict, behavioural accountability, and a common vision were addressed in a small group practice through regular meetings, retreats, and an objective assessment by allied health professionals to improve group function.
Orton et al., 2012	Survey	Physicians	Higher rates of depersonalization were identified in GPs in the UK working in group practices vs solo practices which was felt to be due to poor interpersonal relationships as well as increased demands and less autonomy.
Burns et al., 2013	Review	Physicians	Currently, part of the reason larger groups in the United States may be forming is because they are able to leverage insurers more effectively and build up more market share. Groups with over 100 physicians are increasing.
Damiani et al., 2013	Systematic Review	Patients Physicians Healthcare Systems	Greater uptake of health information technology in GP group practices compared to solo practices and a higher satisfaction with compensation was noted.
Mosaly et al., 2013	Abstract	Physicians	Physicians who cross-cover patients may perceive that their workloads are increased, and performance decreased.

Welch et al., 2013	Cross-sectional Study	Physicians	Between 2009 and 2011, groups of greater than 100 physicians continued to increase in number, with a decrease in the number of solo practitioners.
Xierali et al., 2013	Survey	Physicians	Family physicians in solo or small practices were less likely to adopt electronic health records compared to those in larger group practices.
Heimeshoff et al., 2014	Survey	Physicians	Technical efficiencies were higher for group practices, but this was also associated with higher costs compared to solo practices.
Robinson & Miller, 2014	Cross-sectional Study	Physicians	Hospital owned physician groups had higher costs than physician owned groups in California between 2009 and 2012.
Schulte et al., 2014	Survey	Physicians	Family physicians were less likely to pass the American Board of Family Medicine maintenance of certificate exam if they were in a solo practice which was thought to result from the ability to spend more time on quality improvement and education within a group practice (OR 0.48 [95%CI 0.34 – 0.68]).
Streu et al.,	Survey	Physicians	Working in a group practice was identified as a practice characteristic

2014			associated with professional burnout in plastic surgeons and comments from the survey seemed to indicate that this was due to poor interpersonal relationships within groups.
Valentine et al., 2014	Survey	Physicians	Surgeons working in solo practice were less likely to pass their maintenance of certification examination compared to those in group practices (OR 0.22 [95% CI 0.06-0.77]).
Kralewski et al., 2015	Survey	Physicians	Group practices that focus on improved screening and monitoring may improve avoidable utilization, cost, and revenue.
Moosa et al., 2016	Survey	Physicians	GPs working in groups were more optimistic about the future compared to solo practitioners and worked fewer days but saw more patients per day.
Muhlestein & Smith, 2016	Cross-sectional Study	Physicians	Between 2013 and 2015, the largest changes in group practice size were a decrease in small groups and an increase in very large groups of over 100 physicians. Groups of 100 or more increased from 29.6% to 35.1%. Groups with 1-2 physicians decreased from 22.5% to 19.8%.
Fryer et al., 2017	Survey	Patients	Improved utilization of emergency department and outpatient resources amongst patients with chronic illnesses in group practices who perceive a

			higher level of integration.
Gisler, Bachofner, Moser-Bucher, Scherz, & Streit, 2017	Survey	Physicians	Young GPs in Switzerland prefer to work part-time in group practices of up to 5 physicians.
Kwietniewski et al., 2017	Survey	Physicians	Costs of group practices were higher than those of solo practices due to more investment in technological costs that solo practices would not be able to afford.
Mazurenko et al., 2017	Survey	Physicians	Solo physicians had less health information technology and had less email correspondence with patients and other physicians.
Viehmann et al., 2017	Survey	Physicians	Chronic stress was identified in 26.3% of German GPs and practice assistants with no difference observed between those in solo and group practices.
Baker et al., 2018	Survey	Patients Physicians	The use of HIT, care management processes, and quality improvement processes increased over time, but only quality improvement processes were

			attributable to a larger group size. Additionally, no significant differences were seen in cost and quality between different group sizes.
Kwietniewski & Schreyögg, 2018	Survey	Physicians	Group practices of all sizes and most specialties have been shown to have more technical, cost, and profit efficiencies than solo practices and this was thought to be due to the standardization of processes.
Noroxe et al., 2018	Survey	Physicians	More than half of Danish GPs reported at least one burnout symptom. Those in group practices were less likely to report a poor work-life balance compared to solo GPs.

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	4-5
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	5
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	6
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	6
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Supp App B
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	6-7
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	7
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	7

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	8 Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	8 Supp App A
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	8-14 Supp App A
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	8-14
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	15-17
Limitations	20	Discuss the limitations of the scoping review process.	18
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	18-19
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	19

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.