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The impact of C-level positions on hospital performance: a scoping review protocol

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Abstract

Introduction: The objective of this scoping review is to identify evidence of the impact of hospital managers in top management (c-suite) on hospital performance. Managers generally have various effects on organizational objectives of their organizations. In recent years, the healthcare sector has experienced alterations in hospital governance structures, together with the emergence of new c-suit positions, aligning more closely with those found in private organizations. Their impact on hospital performance (i.e., quality of care) is not well known. This scoping review seeks to identify all the available evidence of their impact on the organizational objectives of a hospital. This scoping review will include primary studies, reviews, and commentaries that describe the impact of top management team members on organizational outcomes in a hospital setting.

Methods and analysis: The search strategy aimed to locate both published and unpublished documents using a three-step search strategy. An exploratory search of MEDLINE and Google Scholar identified keywords and Medical Subject Headings terms. A second search of MEDLINE (PubMed), Web of Science Core Collection, ScienceDirect, Business Source Premier (EBScoHost), JSTOR, BASE, and Lens. org will be performed. The scope of the search will cover from 1990-present time using English search terms. Manual searching by two reviewers will be added to the search strategy. The identified documents will be independently screened, selected by two researchers, and extracted by one researcher. The data are presented in tables and graphics coupled with a descriptive summary.

Ethics and dissemination: As this study neither involves human participants nor unpublished secondary data. Thus, an ethics approval is not required. Findings will be disseminated through professional networks, conference presentations and publication in a scientific journal.

Registration: The protocol was registered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/EBKUP)

Strengths and limitations of this study

- This scoping review protocol is the first to focus on the hospital wide impacts of the top-management team that also includes new positions that have only been implemented in hospitals in the last years
- The review will take a rigorous approach, adhering to the Preferred Reporting Items for Systematic Review and Meta-Analyses extension for Scoping Reviews tool and the most current guidance on conducting scoping reviews by the Joana Briggs Institute, in order to ensure a systematic approach to searching, screening and reporting.
- This scoping review may miss studies that are published outside of the English or German language
- This review will not report on effectiveness or the methodological quality of the included studies

Introduction

While delivering clinically effective, safe, and efficient healthcare is a challenge in its own right, global developments and trends, such as demographic transition and medical-technical progress, accentuate these challenges on nearly all levels of the healthcare delivery process(1). Overall, available resources are limited in every healthcare system, which heightens the need to ensure their efficient and fair use to deliver high-value care for the population. One string of strategies for increasing the value of healthcare delivery centers around innovations in healthcare administration, such as new leadership roles and styles or the restructuring of hospital governance(2, 3).

Hospitals constitute a vital part of the healthcare delivery process in every healthcare system and, as such, can have system-level impacts on the innovative performance of healthcare services(4). One current way of innovation in the hospital sector is the change in the governance of hospitals. Publically owned and administered hospitals have undergone a transformation to resemble the organizational models of the private sector, such as installing a Chief Executive Officer (CEO)(5). Other traditional c-suite roles that have become more prominent in the hospital sector are, for instance, the Chief Financial Officer (6) or the Chief Technical Officer(7). Consequently, these developments have led to a stream of research investigating whether and how new management practices or governance models affect the performance of healthcare organizations(see for instance 8). Recent studies have investigated the correlation between management practices, patient mortality, (9) and organizational innovativeness(10).

Consequently, tailored management and leadership models for healthcare organizations, such as medical leadership(11), have emerged, leading to questions about how healthcare leaders can influence the organizational culture and outcomes of their organizations(12–14). This line of research is based on the premise that an organization's top executive actions have a measurable impact on organizational-level outcomes(15, 16). In this context, it can be argued that the inclusion of new members in organizations' top management teams is a strategic response to both internal institutional and external environmental complexities(17). For instance, the inclusion of a Chief Patient Experience Officer can be seen as a reaction to the growing importance of patient-reported outcomes in reimbursement models and quality measurements in healthcare delivery(18). The growing concerns and awareness about environmental waste in general, and in the healthcare sector in particular, find an expression in the establishment of a Chief Environment Officer(19). In addition, the greater recognition of nursing professionals and their key role in the healthcare process necessitates a greater

representation of the top management team in hospitals, such as the Chief Nursing Officer or Nurse Executives(20, 21).

From research as well as from a healthcare management perspective, a comprehensive picture is missing that would allow for a substantiated overview of the impact that c-suite positions have on the performance of hospitals. Providing a comprehensive overview of the influence of hospital managers on organizational performance can foster mutual understanding and appreciation of the different roles in the healthcare delivery process. Additionally, a key management challenge involves discerning who to recruit for emerging tasks and responsibilities in areas where the organization lacks substantial experience, such as Artificial Intelligence in medicine. This overview can serve as a valuable tool for hospitals, aiding in strategic hiring decisions and identifying areas of hospital performance that require the right personnel.

This scoping review aims to provide a comprehensive understanding of how hospital managers within top management teams influence hospital performance. The evidence was mapped to show the impact of the c-suite (participants) of a hospital (context) on hospital performance (concept). For the population of hospital managers, the review will focus on both established top management positions (i.e., Chief Financial Officer) and novel leadership roles (i.e., Chief Experience Officer) across different hospital contexts. While middle management managers in hospitals are influential in their own right, the top management team usually has a greater influence on sustainable and long-term strategic decision-making, which has wider implications for the organization as a whole(22). Organizational objectives or hospital performance is a widely interpreted term and can include the quality of care or the financial performance of the organization, among others(23). Inpatient care settings were chosen as the relevant context, as hospitals are complex organizations and subject to various external developments that necessitate the inclusion of a diverse range of managers with distinct skill sets.

A scoping review is an appropriate method to identify existing literature and provide a rigorous and transparent overview of the potentially disparate evidence on this topic(24, 25). A preliminary search was conducted on November 1st, 2023, in *MEDLINE (PubMed)*, the *Cochrane Database of Systematic Review* and *JBI Evidence Synthesis* and no current or planned review on the topic was identified. In 2020, a previously published systematic review collected contemporary empirical evidence of the relationship between hospital governance and performance(26). However, the focus of this study was on the processes, dynamics, and interconnections between the hospital board and individual members of hospital management. Based on their findings, the authors argue that the role of the Chief Medical Officer needs to be further explored, which this study aims to map in this scoping review.

Another recent review from 2019 focused exclusively on hospital boards and their impact on the organization(27). Other reviews in the field of leadership research focus on the influences of specific practices or characteristics of hospital managers (28) or aim to provide a realistic view of medical leaders in healthcare(12). Lega et al. (2017) advocated that forthcoming studies should focus on elucidating the mechanisms or mediators through which hospital managers instigate these changes or positive effects. To the best of our knowledge, no other review has specifically addressed this topic with an exclusive focus on the top management team, encompassing both traditional and emerging c-level positions. This review presents comprehensive evidence of the impact of these positions on hospital performance.

Review question(s)

What are the impacts on hospital performance of top managers of the c-suite in hospitals?

i) Through which mechanisms or mediators have the hospital managers achieved these impacts?
ii) In what areas of hospital performance and through which hospital performance indicators have these impacts been realized?
iii) What are the methodological approaches in this field?

Inclusion criteria

Participants

This review considers studies that include senior managers in hospitals and belong to the so-called "c-suite" or the top management team. Hospital managers should be employees of the hospital and not serve an interim function (e.g., consultant). The CEO is excluded from consideration because the primary focus is on the more specialized members of top management teams. In addition, the CEO, being involved in every organizational aspect of the hospital, introduces ambiguity in attributing a specific impact on hospital performance. Other hospital managers from different settings (e.g., senior clinicians), specialist managers (e.g., case managers), middle management, and board members of the hospital were excluded.

Concept

The concepts of interest are studies that explore their impact on hospital performance and

organizational objectives. Hospital performance can refer to a variety of indicators and factors that, among others, relate to the quality of care and financial efficiency(23). These factors include, but are not limited to, efficiency, clinical effectiveness, patient-centeredness, staff orientation, equity, expenditure, cost, and utilization of resources. Studies were included when they suggested a causal effect of the change in hospital performance due to the position of the top-level hospital manager in question.

Context

This review will consider studies in the context of tertiary care and include acute care hospitals as well as specialized hospitals, irrespective of geographic location, size, or ownership. Other healthcare organizations such as public health institutions, community health services or facilities that provide long-term care are not included.

Types of sources

This scoping review considers both published and unpublished evidence. These sources will consider quantitative, qualitative, and mixed-methods study designs, irrespective of the methodological approach. In addition, systematic reviews and commentaries were included in the proposed scoping review. Conference abstracts, seminar proceedings, meeting notes, and books were not eligible for this review.

Methods

The proposed scoping review will be conducted in accordance with the JBI methodology for scoping reviews (29) and in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)(30). This protocol was registered in the Open Science Framework (https://doi.org/10.17605/OSF.IO/EBKUP).

Search strategy

The three-step search strategy aimed to locate both published and unpublished primary studies, reviews, and text and opinion papers. An initial limited search of MEDLINE (PubMed) and Google Scholar was performed to identify relevant articles. The text words contained in the titles and abstracts of relevant articles and the Medical Subject Headings terms used to describe the articles were used to develop a full search strategy for MEDLINE (PubMed) (see Appendix I). The search

strategy, including all the identified keywords and index terms, was adapted for each information source. The reference lists and citations of the articles selected for full-text review were screened for additional papers using *citationchaser* to minimize the risk of overlooking relevant references(31). Sources of evidence published in English and German from 1990 to the present are also included. While research on hospital managers has a longer history, the emergence of newer positions within the top management team, such as the Chief Medical Information Officer, can be attributed to the advancements and possibilities associated with new technologies and digitalization of healthcare processes.

The databases searched included MEDLINE (PubMed), Web of Science Core Collection, Business Source Premier (EBScoHost), and ScienceDirect. Sources of unpublished studies and grey literature to be searched include BASE and Lens. org. The study authors will be contacted via email when relevant information might be missing or poorly reported.

Study/Source of evidence selection

Following the search, all identified records were collated and uploaded to Rayyan (32) and duplicates were removed. Following a pilot test by selecting a random sample of 30 titles and abstracts, titles and abstracts are screened by two independent reviewers (DH and MZ) to assess the inclusion criteria for the review. Potentially relevant papers are retrieved, and their citation details imported into Citavi v.6.17 (Swiss Academic Software GmbH, Wädenswil, Switzerland). Full-text citations will be reviewed in detail against the selection criteria by one reviewer (DH), with a second reviewer (MZ) providing further input, if necessary. Any disagreements between the reviewers at each stage of the selection process will be resolved through discussion or with the help of a third reviewer (EN or DA). The reasons for exclusion of full-text papers that do not meet the inclusion criteria will be recorded and reported in the scoping review. The results of the search will be reported in full in the final scoping review and presented in a preferred reporting item for systematic reviews and meta-analysis (PRISMA) flow diagram(33).

Data extraction

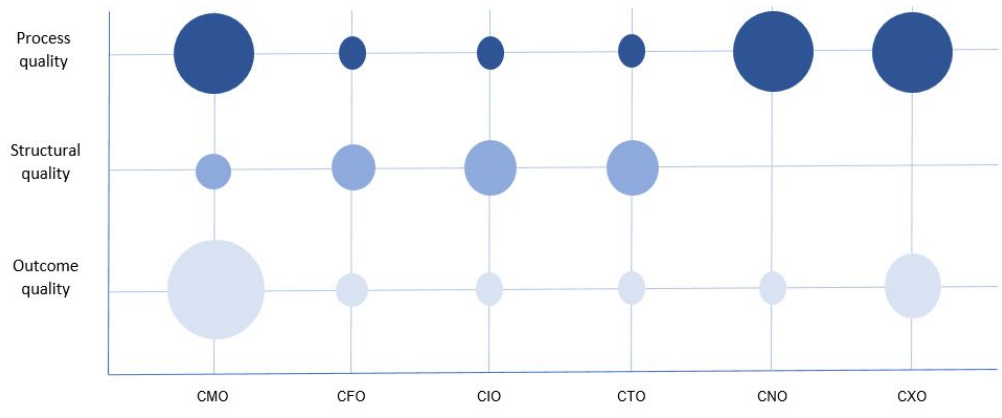
Data will be extracted from the papers included in the scoping review by one reviewer and checked by a second reviewer. A specifically designed Excel spreadsheet (Redmond, Washington, USA) developed by the authors was used as a data extraction tool. The extracted data will include specific

details about the type of hospital manager (e.g., CFO, CXO), hospital performance measurement (e.g., quality of care, financial performance), type of hospital setting (e.g., single hospital, hospital network), methods (e.g., methodology and study type), and key findings relevant to the review question (see Appendix II). The data extraction tool was pilot tested by two independent reviewers (DH and MZ) based on six pre-identified studies. The extraction fields for context and concept were adjusted to better capture relevant data from the studies. The data extraction tool will be modified and revised as necessary during the process of extracting data. The modifications are detailed in the full scoping review. Authors of papers will be contacted to request missing or additional data where required.

Data analysis and presentation

Relevant data for each source of evidence will be extracted to identify and explore the impact of top management team managers on hospital performance. Data will be presented in a tabular format, indicating the methodological approach, manager type, publication details, and impact on the different aspects of hospital performance. Additional data presentation styles (see Figure 1) will be considered for presenting the data based on healthcare quality concepts encompassing process, structural, and outcome parameters(34). A frequency analysis will show the availability of evidence in different fields of hospital performance for different types of hospital managers. The results of the review are presented in a narrative summary and describe how the results relate to the review objectives and questions.

Fig. 1: Impact of hospital managers' matrix



Registration: The protocol was registered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/EBKUP)

Ethics and dissemination: As this study neither involves human participants nor unpublished secondary data. Thus, an ethics approval is not required. Findings will be disseminated through professional networks, conference presentations and publication in a scientific journal.

Authors contributions: DH and MZ led the conceptualisation and design of this work. DH wrote the first draft, incorporated feedback, and finalized the manuscript. All other authors contributed to the discussions and initial ideas for the manuscript, provided feedback, and approved the final draft.

Funding: The Robert Bosch Foundation funds this study. The funder will have no influence on the conduct and reporting of the scoping review.

Competing interests: The authors declare no conflict of interests.

Patient and public involvement: Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

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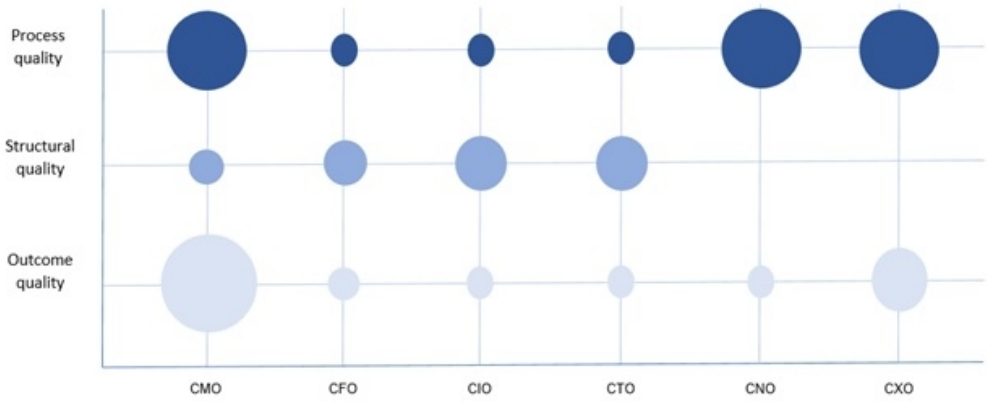

Impact of hospital managers' matrix

163x68mm (96 x 96 DPI)

Appendix I: Search strategy

MEDLINE (PubMed)

Date searched: February 22, 2024 Records retrieved: 3,691

Search	Query	Records retrieved
#1	"c suite"[Title/Abstract] OR "c suite executives"[Title/Abstract] OR "c suite level"[Title/Abstract] OR "institutional management teams"[MeSH Terms] OR "top management team"[Title/Abstract] OR "executive team"[Title/Abstract] OR "executive*"[Title/Abstract] OR "chief executive officers, hospital"[MeSH Terms] OR "senior management"[Title/Abstract] OR "senior leadership"[Title/Abstract] OR "hospital administrators"[MeSH Terms]	78,771
#2	"chief medical officer"[Title/Abstract] OR "physician executive"[Title/Abstract] OR "clinician executive"[Title/Abstract] OR "chief nursing officer"[Title/Abstract] OR "chief nurse executives"[Title/Abstract] OR "executive nurse directors"[Title/Abstract] OR "nurse administrators"[MeSH Terms] OR "chief clinical informatics officer"[Title/Abstract] OR "chief medical information officer"[Title/Abstract] OR "chief clinical information officer"[Title/Abstract] OR "chief patient experience officer"[Title/Abstract] OR "patient experience officer"[Title/Abstract] OR "chief operating officer"[Title/Abstract] OR "executive director"[Title/Abstract] OR "chief financial officer"[Title/Abstract] OR "financial executive*"[Title/Abstract]	16,047
#3	#1 OR #2	92,141
#4	(("hospital"[Title/Abstract] OR ("organizational"[Title/Abstract])) AND ("objective"[Title/Abstract] OR "impact*"[Title/Abstract] OR "performance"[Title/Abstract] OR ("outcome*"[Title/Abstract] OR "effect*"[Title/Abstract])) OR "organizational objectives"[MeSH Terms]	774,954
#5	"Hospitals"[MeSH Terms] OR "inpatient*"[Title/Abstract] OR "hospital*"[Title/Abstract]	1,867,882
#6	#3 AND #4 AND #5	4,003
Limited to 1990-present, English and German only		**3,691**

Appendix II: Data extraction tool

Evidence source details and characteristics	
Citation details (eg, authors, date, title, journal, issue, pages)	
Type of evidence source (eg, review, qualitative, quantitative, mixed methods, opinion, thesis)	
Country (eg, geographic location of the study)	
Hospital setting (eg, single hospital, network, rural/urban)	
Participants (eg, manager position, numbers)	
Aim/purpose/objective of source	
Details extracted from source of evidence (in relation to the concept of the scoping review)	
Definition of the manager position and its responsibilities and tasks	
Type of the impact on hospital performance (eg, quality of care, structural quality, financial performance, process key performance indicators)	
Mechanism or mediators through which the manager achieved these results (eg, communication, leadership, network)	
How was this outcome measured? (eg, key performance indicator, self assessment)	

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

Scoping Review Protocol: The impact of C-level positions on hospital performance: a scoping review protocol

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.	3-4
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.	4-5
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.	7
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.	7
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	12
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	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.	7-8
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	NA for protocol

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
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).	NA for protocol
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	8
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.	NA for protocol
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	NA for protocol
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	NA for protocol
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.	NA for protocol
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	NA for protocol
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.	NA for protocol
Limitations	20	Discuss the limitations of the scoping review process.	NA for protocol
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.	NA for protocol
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.	9

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.

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The impact of C-level positions on hospital performance: a scoping review protocol

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The impact of C-level positions on hospital performance: a scoping review protocol

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Abstract

Introduction: The objective of this scoping review is to identify evidence of the impact of hospital managers in top management (c-suite) on hospital performance. Managers generally have various effects on organizational objectives of their organizations. In recent years, the healthcare sector has experienced alterations in hospital governance structures, together with the emergence of new c-suit positions, aligning more closely with those found in private organizations. Their impact on hospital performance (i.e., quality of care) is not well known. This scoping review seeks to identify all the available evidence of their impact on the organizational objectives of a hospital. This scoping review will include primary studies, reviews, and commentaries that describe the impact of top management team members on organizational outcomes in a hospital setting.

Methods and analysis: The search strategy aimed to locate both published and unpublished documents (i.e. grey literature) using a three-step search strategy. An exploratory search of MEDLINE and Google Scholar identified keywords and Medical Subject Headings terms. A second search of MEDLINE (PubMed), Web of Science Core Collection, ScienceDirect, Business Source Premier (EBScoHost), JSTOR, BASE, Lens.org and the Google Search Engine will be performed. The scope of the search will cover 1990-present time using English search terms. Manual searching by two reviewers will be added to the search strategy. The identified documents will be independently screened, selected by two researchers, and extracted by one researcher. The data are then presented in tables and graphics coupled with a descriptive summary.

Ethics and dissemination: As this study neither involves human participants nor unpublished secondary data, an ethics approval is not required. Findings will be disseminated through professional networks, conference presentations and publication in a scientific journal.

Registration: The protocol was registered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/EBKUP)

Strengths and limitations of this study

- This scoping review protocol is the first to focus on the hospital-wide impacts of the top-management team that also includes new positions that have only been implemented in hospitals in the last years
- The review will take a rigorous approach, adhering to the Preferred Reporting Items for Systematic Review and Meta-Analyses extension for Scoping Reviews tool and the most current guidance on conducting scoping reviews by the Joana Briggs Institute, in order to ensure a systematic approach to searching, screening and reporting.
- This scoping review may miss studies that are published outside of the English or German language sphere
- This review will not report on the effectiveness or the methodological quality of the included studies

Introduction

While delivering clinically effective, safe, and efficient healthcare is a challenge in its own right, global developments and trends, such as demographic transition and medical-technical progress, accentuate these challenges on nearly all levels of the healthcare delivery process (1). Overall, available resources are limited in every healthcare system, which heightens the need to ensure their efficient and fair use to deliver high-value care for the population. One strand of strategies for increasing the value of healthcare delivery centers around innovations in healthcare administration, such as new leadership roles and styles or the restructuring of hospital governance (2, 3).

Hospitals constitute a vital part of the healthcare delivery process in every healthcare system and, as such, can have system-level impacts on the innovative performance of healthcare services (4). One current way of innovation in the hospital sector is change in the governance of hospitals. Publically owned and administered hospitals have undergone a transformation to resemble the organizational models of the private sector, such as installing a Chief Executive Officer (CEO) (5). Other traditional c-suite roles that have become more prominent in the hospital sector are, for instance, the Chief Financial Officer (6) or the Chief Technical Officer (7). Consequently, these developments have led to a stream of research investigating whether and how new management practices or governance models affect the performance of healthcare organizations (see for instance 8). Recent studies have investigated the correlation between management practices, patient mortality, (9) and organizational innovativeness (10).

Consequently, tailored management and leadership models for healthcare organizations, such as medical leadership (11), have emerged, leading to questions about how healthcare leaders can influence the organizational culture and outcomes of their organizations (12–14). This line of research is based on the premise that an organization's top executive actions have a measurable impact on organizational-level outcomes (15, 16). In this context, it can be argued that the inclusion of new members in organizations' top management teams is a strategic response to both internal institutional and external environmental complexities (17). For instance, the inclusion of a Chief Patient Experience Officer can be seen as a reaction to the growing importance of patient-reported outcomes in reimbursement models and quality measurements in healthcare delivery (18). The growing concerns and awareness about environmental waste in general, and in the healthcare sector in particular, find an expression in the establishment of a Chief Environment Officer (19). In addition, the greater recognition of nursing professionals and their key role in the healthcare process necessitates a greater

representation of the top management team in hospitals, such as the Chief Nursing Officer or Nurse Executives (20, 21).

From research as well as from a healthcare management perspective, a comprehensive picture that would allow for a substantiated overview of the impact that c-suite positions have on the performance of hospitals is missing. Providing a comprehensive overview of the influence of hospital managers on organizational performance can foster mutual understanding and appreciation of the different roles in the healthcare delivery process. Additionally, a key management challenge involves discerning who to recruit for emerging tasks and responsibilities in areas where the organization lacks substantial experience, such as Artificial Intelligence in medicine. This overview can serve as a valuable tool for hospitals, aiding in strategic hiring decisions and identifying areas of hospital performance that require the right personnel. As many hospitals are publically funded, this scoping review might be useful for political decisions-makers in the healthcare sector, providing them with more adequate information.

This scoping review aims to provide a comprehensive understanding of how hospital managers within top management teams influence hospital performance. The evidence will be mapped to show the impact of the c-suite (participants) of a hospital (context) on hospital performance (concept). For the population of hospital managers, the review will focus on both established top management positions (i.e., Chief Financial Officer) and novel leadership roles (i.e., Chief Experience Officer) across different hospital contexts. While mid-level managers in hospitals are influential in their own right, the top management team usually has a greater influence on sustainable and long-term strategic decision-making, which has wider implications for the organization as a whole (22). Organizational objectives or hospital performance is a widely interpreted term and can include the quality of care or the financial performance of the organization, among others (23). We approximate the concept of hospital performance through indicators relating to (i) efficiency/utilization, (ii) financial, and (iii) effectiveness of hospitals (24). Hereby, efficiency/utilization indicators relate to the process of healthcare delivery, finance to financial indicators of the organizations and effectiveness to the outcomes of the services (including safety, quality and access to care). Inpatient care settings were chosen as the relevant context, as hospitals are complex organizations and subject to various external developments that necessitate the inclusion of a diverse range of managers with distinct skill sets.

A scoping review is an appropriate method to identify existing literature and provide a rigorous and transparent overview of the potentially disparate evidence on this topic (25, 26). A preliminary search was conducted on November 1st, 2023, in *MEDLINE (PubMed)*, the *Cochrane Database of Systematic Review* and *JBI Evidence Synthesis* and no current or planned review on the topic was identified. In

2020, a previously published systematic review collected contemporary empirical evidence of the relationship between hospital governance and performance (27). However, the focus of this study was on the processes, dynamics, and interconnections between the hospital board and individual members of hospital management. Based on their findings, the authors argue that the role of the Chief Medical Officer needs to be further investigated, which this study aims to map in this scoping review. Another review from 2019 focuses exclusively on hospital boards and their impact on the organization (28). Other reviews in the field of leadership research focus on the influences of specific practices or characteristics of hospital managers (29) or aim to provide a realistic view of medical leaders in healthcare (12). Lega et al. (2017) advocate that forthcoming studies should concentrate on elucidating the mechanisms or mediators through which hospital managers instigate these changes or positive effects. To the best of our knowledge, no other review has specifically addressed this topic with an exclusive focus on the top management team, encompassing both traditional and emerging c-level positions. This review will present comprehensive evidence for the impact of these positions on hospital performance.

Review question(s)

What are the impacts on hospital performance of top managers of the c-suite in hospitals?

i) What are the methodological approaches used in this line of research?
ii) In what areas of hospital performance and through which hospital performance indicators have these impacts been realized?
iii) Through which mechanisms or mediators have the hospital managers achieved these impacts?

Inclusion criteria

Participants

This review considers studies that include senior managers in hospitals and who belong to the so-called “c-suite” or the top management team. Hospital managers should be employees of the hospital and not serve an interim function (e.g., consultant). The CEO is excluded from consideration because the primary focus is on the more specialized members of top management teams. In addition, the inclusion of CEOs, being involved in every organizational aspect of the hospital, would introduce ambiguity in attributing a specific impact on hospital performance. Other hospital managers from different settings (e.g., senior clinicians), specialist managers (e.g., case managers), middle

management, and board members of the hospital were also excluded.

Concept

The concepts of interest are studies that explore their impact on hospital performance and organizational objectives. Assessing performance indicators in hospitals assists policy-makers and managers to monitor performance and payment systems. Hospital performance can refer to a variety of indicators and factors that, among others, relate to the quality of care and financial efficiency (23). The overall model of hospital performance is based on the categories efficiency/utilisation, finance, and effectiveness (24). These factors include, but are not limited to, efficiency, clinical effectiveness, patient-centeredness, staff orientation, equity, expenditure, cost, and utilization of resources. Studies were included when they suggested a causal relationship of the change in hospital performance due to the position of the top-level hospital manager in question.

Context

This review will consider studies in the context of tertiary care and include acute care hospitals as well as specialized hospitals, irrespective of geographic location, size, or ownership. Other healthcare organizations such as public health institutions, community health services or facilities that provide long-term care are not included.

Types of sources

This scoping review considers both published and unpublished evidence (i.e. grey literature). These sources will contain quantitative, qualitative, and mixed-methods study designs, irrespective of the methodological approach. In addition, systematic reviews and commentaries were included in the proposed scoping review. Conference abstracts, seminar proceedings, meeting notes, and books are not eligible for this review.

Methods

The proposed scoping review will be conducted in accordance with the JBI methodology for scoping reviews (30) and in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)(31). This protocol was registered in the Open Science Framework (https://doi.org/10.17605/OSF.IO/EBKUP).

Patient and Public Involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Search strategy

The three-step search strategy aims to locate both published and unpublished primary studies, reviews, and text and opinion papers. An initial limited search of MEDLINE (PubMed) and Google Scholar was performed to identify relevant articles. The text words contained in the titles and abstracts of relevant articles and the Medical Subject Headings terms used to describe the articles were used to develop a full search strategy for MEDLINE (PubMed). The search strategy, including all the identified keywords and index terms, were adapted for each information source (see Appendix I). The reference lists and citations of the articles selected for full-text review will be screened for additional papers using *citationchaser* to minimize the risk of overlooking relevant references (32). Sources of evidence published in English and German from 1990 to the present are included. This time span was chosen, as the emergence of newer positions within the top management team, such as the Chief Medical Information Officer, can be attributed to the advancements and possibilities associated with new technologies and digitalization of healthcare processes.

The databases searched include MEDLINE (PubMed), Web of Science Core Collection, Business Source Premier (EBScoHost), and ScienceDirect. Sources of unpublished studies or grey literature to be searched include BASE, Lens.org and the Google Search Engine.

Study/Source of evidence selection

Following the search, all identified records will be collated and uploaded to Rayyan (33) and duplicates will be removed. Following a pilot test by selecting a random sample of 30 titles and abstracts, titles and abstracts are screened by two independent reviewers (DH and MZ) to assess the inclusion criteria for the review. Potentially relevant papers will be retrieved, and their citation details imported into Citavi v.6.17 (Swiss Academic Software GmbH, Wädenswil, Switzerland). Full-text citations will be reviewed in detail against the selection criteria by one reviewer (DH), with a second reviewer (MZ) providing further input, if necessary. Any disagreements between the reviewers at each stage of the selection process will be resolved through discussion or with the help of a third reviewer (EN or DA). The reasons for exclusion of full-text papers that do not meet the inclusion criteria will be recorded

and reported in the scoping review. The results of the search will be reported in full in the final scoping review and presented in a preferred reporting item for systematic reviews and meta-analysis (PRISMA) flow diagram (34).

Data extraction

Data will be extracted from the papers included in the scoping review by one reviewer and checked by a second reviewer. A specifically designed Excel spreadsheet (Microsoft Office Professional Plus 2016, Redmond, Washington, USA) was developed by the authors and will be used as a data extraction tool. The extracted data will include specific details about the type of hospital manager (e.g., CFO, CXO), hospital performance measurement (e.g., quality of care, financial performance), type of hospital setting (e.g., single hospital, hospital network), methods (e.g., methodology and study type), and key findings relevant to the review question (see Appendix II). The data extraction tool was pilot tested by two independent reviewers (DH and MZ) based on six pre-identified studies. The extraction fields for context and concept were adjusted to better capture relevant data from the studies. The data extraction tool will be modified and revised as necessary during the process of extracting data. The modifications are detailed in the full scoping review. Authors of papers will be contacted to request missing or additional data where required.

Data analysis and presentation

Relevant data for each source of evidence will be extracted to identify and explore the impact of top management team managers on hospital performance. Data will be presented in a tabulated format, indicating the methodological approach, manager type, publication details, and impact on the different aspects of hospital performance. The data will be extracted according to each research question (see Appendix II). Also, in accordance with our data extraction sheet, the results will be presented linked to each research question. Additional data presentation styles (see Figure 1) will be considered for presenting the data based on healthcare quality concepts encompassing process, structural, and outcome parameters (35). A frequency analysis will show the availability of evidence in different fields of hospital performance for different types of hospital managers. The results of the review are presented in a narrative summary and describe how the results relate to the review objectives and questions.

Fig. 1: Impact of hospital managers' matrix

Registration: The protocol was registered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/EBKUP)

Ethics and dissemination: As this study neither involves human participants nor unpublished secondary data. Thus, an ethics approval is not required. Findings will be disseminated through professional networks, conference presentations and publication in a scientific journal.

Authors contributions: DH and MZ led the conceptualisation and design of this work. DH wrote the first draft of the manuscript, incorporated feedback, and finalized the manuscript with MZ. MDA and EN contributed to the discussions and initial ideas during the conceptualisation stage and provided feedback on the manuscript. All authors approved the final draft.

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Figure caption: Impact of hospital managers' matrix (Figure 1)

The figure shows the most frequently available evidence for each kind of hospital manager and their impact on the hospital quality concepts: process, structural and outcome quality. The x-axis lists the different kinds of hospital managers in the c-suite; the y-axis lists the different kinds of hospital quality concepts.

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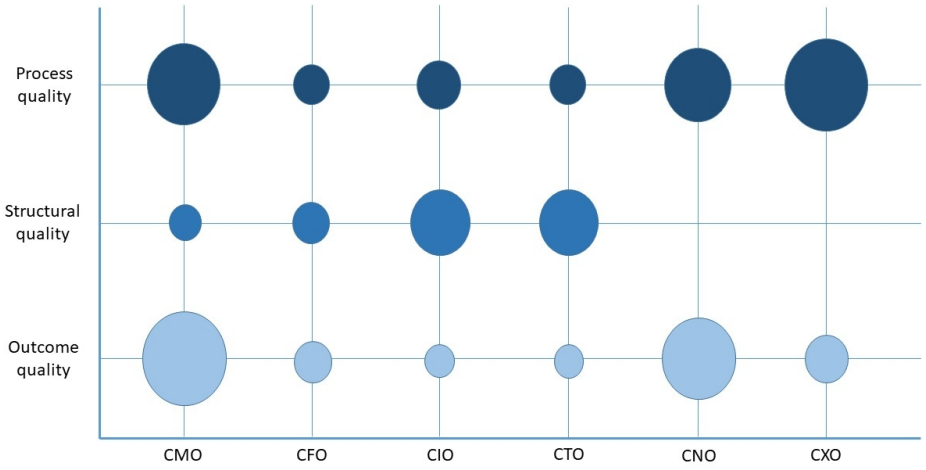

The figure shows the most frequently available evidence for each kind of hospital manager and their impact on the hospital quality concepts: process, structural and outcome quality. The x-axis lists the different kinds of hospital managers in the c-suite; the y-axis lists the different kinds of hospital quality concepts.

338x190mm (96 x 96 DPI)

Appendix I: Search strategy

MEDLINE (PubMed)

Date searched: May 4, 2024 Records retrieved: 3,912

Search	Query	Records retrieved
#1	"c suite"[Title/Abstract] OR “c-suite” [Title{Abstract] OR "c suite executives"[Title/Abstract] OR "c suite level"[Title/Abstract] OR "institutional management teams"[MeSH Terms] OR "top management team"[Title/Abstract] OR "executive team"[Title/Abstract] OR "executive*"[Title/Abstract] OR "chief executive officers, hospital"[MeSH Terms] OR "senior management"[Title/Abstract] OR "senior leadership"[Title/Abstract] OR "hospital administrators"[MeSH Terms]	79,687
#2	"chief medical officer"[Title/Abstract] OR "physician executive"[Title/Abstract] OR "clinician executive"[Title/Abstract] OR "chief nursing officer"[Title/Abstract] OR "chief nurse executives"[Title/Abstract] OR "executive nurse directors"[Title/Abstract] OR "nurse administrators"[MeSH Terms] OR "chief clinical informatics officer"[Title/Abstract] OR "chief medical information officer"[Title/Abstract] OR "chief clinical information officer"[Title/Abstract] OR "chief patient experience officer"[Title/Abstract] OR "patient experience officer"[Title/Abstract] OR "chief operating officer"[Title/Abstract] OR "executive director"[Title/Abstract] OR "chief financial officer"[Title/Abstract] OR "financial executive*"[Title/Abstract]	16,091
#3	#1 OR #2	93,091
#4	("hospital"[Title/Abstract] OR ("organizational"[Title/Abstract] OR "financial"[Title/Abstract])) AND ("objective"[Title/Abstract] OR "impact*"[Title/Abstract] OR "performance"[Title/Abstract] OR ("outcome*"[Title/Abstract] OR "effect*"[Title/Abstract]))) OR "organizational objectives"[MeSH Terms] OR "hospital efficiency"[Title/Abstract] OR "hospital quality"[Title/Abstract] OR "economics, hospital"[MeSH Terms]	867,318
#5	"Hospitals"[MeSH Terms] OR "inpatient*"[Title/Abstract] OR "hospital*"[Title/Abstract]	1,892,098
#6	#3 AND #4 AND #5	4,263
Limited to 1990-present, English and German only		**3,912**

Web of Science Core Collection

Date searched: May 4, 2024 Records: 171

Search	Query	Records retrieved
#1	TS=("c suite" OR "c-suite" OR "executives" OR "top management team" OR "executive team" OR "executive" OR "chief executive officers" OR "senior leadership")	140,233
#2	TS=("chief medical officer" OR "clinician executive" OR "chief nursing officer" OR "chief nurse executive" OR "executive nurse director" OR "chief clinical informatics officer" OR "chief medical information officer" OR "chief clinical information officer" OR "chief patient experience officer" OR "chief operating officer" OR "chief financial officer" OR "financial executive")	978
#3	#1 OR #2	140,900
#4	TS=("hospital performance" OR "hospital outcome" OR "hospital quality" OR "financial performance" OR "organizational performance" OR "organizational outcome" OR "financial outcome" OR "hospital efficiency")	39,790
#5	TS=("hospital" OR "hospitals" OR "inpatient")	1,454,361
#6	#3 AND #4 AND #5	173
Limited to 1990-present, English and German only		**171**

Business Source Premier & EconLit (EbscoHost)

Date searched: 4 May, 2024 Records: 158

Search	Query	Records retrieved
#1	Title and abstract separately searched and then combined with "OR": ("c suite" OR "c-suite" OR "executives" OR "top management team" OR "executive team" OR "executive" OR "chief executive officers" OR "senior leadership")	943,989
#2	Title and abstract separately searched and then combined with "OR": ("chief medical officer" OR "clinician executive" OR "chief nursing officer" OR "chief nurse executive" OR "executive nurse director" OR "chief clinical informatics officer" OR "chief medical	70,534

	information officer" OR "chief clinical information officer" OR "chief patient experience officer" OR "chief operating officer" OR "chief financial officer" OR "financial executive")	
#3	#1 OR #3	992,870
#4	Title and abstract separately searched and then combined with "OR": ("hospital performance" OR "hospital outcome" OR "hospital quality" OR "financial performance" OR "organizational performance" OR "organizational outcome" OR "financial outcome" OR "hospital efficiency")	113,608
#5	Title and abstract separately searched and then combined with "OR": "hospital" OR "hospitals" OR "inpatient"	178,914
#6	#3 AND #4 AND #5	158
Limited to 1990-present, English and German only		**158**

ScienceDirect

Date searched: 4 May, 2024 Records: 5

Search	**Query**	**Records retrieved**
#1	Title, abstract or author-specified keywords: ("c suite" OR "top management team" OR "senior leadership" OR "c-suite") AND ("hospital performance" OR "hospital efficiency" OR "hospital quality" OR "hospital financial performance")	4
#2	Title, abstract or author-specified keywords: ("chief medical officer" OR "chief nursing officer" OR "clinician executive" OR "executive nurse director") AND ("hospital performance" OR "hospital efficiency" OR "hospital quality" OR "hospital financial performance")	1
#3	Title, abstract or author-specified keywords: ("chief clinical informatics officer" OR "chief medical information officer" OR "chief clinical information officer") AND ("hospital performance" OR "hospital efficiency" OR "hospital quality" OR "hospital financial performance")	0
#4	Title, abstract or author-specified keywords: ("chief patient experience officer" OR "chief operating officer" OR "chief financial officer") AND ("hospital performance" OR "hospital efficiency" OR "hospital quality" OR "hospital financial performance")	0
#5	Limited to 1990-present, English and German only	**5**

Grey Literature: Unpublished literature

BASE

Date searched: 4 May, 2024 Records: 44

Search	Query	Records retrieved
#1	Tit: ("c suite" OR "c-suite" OR "executives" OR "top management team" OR "executive team" OR "executive" OR "chief executive officers" OR "senior leadership")	454
#2	Tit: ("chief medical officer" OR "clinician executive" OR "chief nursing officer" OR "chief nurse executive" OR "executive nurse director" OR "chief clinical informatics officer" OR "chief medical information officer" OR "chief clinical information officer" OR "chief patient experience officer" OR "chief operating officer" OR "chief financial officer" OR "financial executive")	502
#3	#1 OR #2	956
#4	Tit: (“hospital performance” OR "hospital outcome" OR "hospital quality" OR "financial performance" OR "organizational performance" OR "organizational outcome" OR "financial outcome" OR "hospital efficiency")	42,927
#5	tit: ("hospital" OR "hospitals" OR "inpatient")	465
#6	#3 AND #4 AND #5	44
Limited to 1990-present, English and German only		**44**

Lens.org

Date searched: 4 May, 2024 Records: 1,602

Search	Query	Records retrieved
#1	("c suite" OR (c-suite OR (executives OR ("top management team" OR ("executive team" OR (executive OR ("chief executive officers" OR ("senior leadership" OR ("chief medical officer" OR ("clinician executive" OR ("chief nursing officer" OR ("chief nurse executive" OR ("executive nurse director" OR ("chief clinical informatics officer" OR ("chief medical information officer" OR ("chief clinical information officer" OR ("chief patient experience officer" OR ("chief operating officer" OR ("chief financial officer" OR "financial executive") AND (("hospital performance" OR ("hospital outcome" OR ("hospital quality" OR ("financial performance" OR ("organizational performance" OR (	1,680

	"organizational outcome" OR ("financial outcome" OR "hospital efficiency"))))))) AND (hospital OR (hospitals OR inpatient)))	
Limited to 1990-present, English and German only		**1,602**

Google Search Engine

- *Name/URL*: https://www.google.com/
- *Dates searched*: 4 May, 2024
- *Search terms*: We combined search terms from the population part of the search strategy ("c suite", "chief medical officer", etc.) and combined them with terms from the concept and context part of the search strategy ("hospital efficiency", "hospital performance", "hospital financial performance")
- *Selection of results*: The first 200 results returned from the search strategy were scanned for relevance and those judged to be potentially relevant were followed up.

Appendix II: Data extraction tool

Review Question	Data to be extracted	Coding examples
Review Question 1 **General Information** **"What are the methodological approaches in this field?"**	Authors/title	N/A
	Year of publication	• Year of publication versus date of collected samples
	Research Country	List of countries
	Research design	Empirical study designs • Quantitative (longitudinal vs. cross-sectional; statistical methods; survey) • Qualitative (Interviews, open surveys) • Mixed methods • Limitations
	Characteristics of hospitals	• Public versus private ownership • For-profit versus non-for-profit • General vs specialist hospital vs hospital network • Rural versus urban • Data: publicly available versus not publicly available (self-collected)
Review Question 2 **"Through which mechanisms or mediators have the hospital managers these impacts?"**	Aim/purpose of the study	Description of the overall impacts on hospital performance by the top managers
	Leadership position / hospital manager	• Description of position (e.g. CMO, CFO, CXO, etc) • Description of the responsibilities or tasks • Use of strategy/mechanism (e.g. communication, leadership style)
Review Question 3 **"In what areas of hospital performance and through which hospital performance indicators have these impacts been realized?"**	Type of impact on hospital performance	• Efficiency/utilization versus financial versus effectiveness
	Measurement of outcome	• Objective (e.g. KPI) versus subjective (self-assessment)
	Affected by the c-suite	• Patients, staff, stakeholders • Inside versus outside the organization • Hospital wide versus several departments vs single department

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

Scoping Review Protocol: The impact of C-level positions on hospital performance: a scoping review protocol

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.	3-4
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.	4-5
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.	7
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.	7
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	12
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	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.	7-8
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	NA for protocol

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
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).	NA for protocol
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	8
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.	NA for protocol
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	NA for protocol
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	NA for protocol
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.	NA for protocol
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	NA for protocol
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.	NA for protocol
Limitations	20	Discuss the limitations of the scoping review process.	NA for protocol
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.	NA for protocol
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.	9

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.