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Unveiling and Categorizing the Benefits of Open Innovation in Healthcare: A Systematic Literature Review

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Abstract

The open innovation (OI) concept for its ability to foster creativity and potentially generate numerous advantages across various sectors. Open innovation is important since it allows industries to enhance product development and optimize services by promoting open ideas, research, and procedures and increasing productivity and efficiency. Innovation enhances the provision of quality, safe, reliable, and affordable healthcare. Therefore, contemporary health systems have migrated to OI to increase the overall patient care process and improve general clinical outcomes. Although OI in healthcare,has the potential to contribute significantly to the industry. Therefore, this systematic review explores the transformative benefits of OI in healthcare and addresses the primary research question: what are the benefits of OI to healthcare?

A systematic literature review was conducted, mobilizing the PRISMA 2020 method and content analysis. A total of 176 articles were reviewed to identify different benefits and categorize them according to the areas they impact. Results revealed ten categories of OI benefits in healthcare, ranging from enhanced collaboration, improved data security, increased inclusivity, positive social impact, proper technological integration, improved healthcare accessibility, innovative solutions to patient care, patient engagement and experience, healthcare procedure optimization, and advanced public health and emergency management.

Keywords: *Open innovation, Collaborative Innovation, Crowd Innovation, Co-Creation, Boundaryless Innovation, External Innovation, benefits, profits.*

INTRODUCTION

Professor Henry Chesbrough first defined open innovation at the Haas Business School at UC Berkeley (2003). According to Ahmed et al. (2023) and Bullinger et al. (2012), it is a paradigm in which firms may and should use external and internal ideas and internal and external paths to market to advance their technology. While the term sounds as though it is pretty revolutionary for many sectors, its application in healthcare is remarkable. The global healthcare sector is facing thousands of challenges, including rising costs, aging populations, and an increasing burden of chronic diseases, all of which are putting massive pressure on existing healthcare systems. In this context, open innovation has emerged as a promising solution. Healthcare organizations can thus innovate faster by utilizing both inbound ideas and paths to markets from external sources, resulting in lower-cost solutions to healthcare problems.

Collaboration and sharing information are among the most essential pillars of open innovation. This takes many forms in the healthcare sector. For example, an independent researcher may collaborate with a pharmaceutical company to expedite drug discovery. This case may involve hospitals sharing patient data to improve patient care with appropriate privacy protections. Policymakers in the health sector can shape health policies (Flessa & Huebner, 2021; Reinhardt et al., 2014). Integrating open innovation into health systems has not been smooth. It is critical to address the vast challenges of data privacy and protection, intellectual property rights, and regulatory compliance ; many health organizations are adopting open innovation to drive operational transformation and significantly enhance patient outcomes (Amjad et al., 2023; Dandonoli, 2013).

This paper aims at reviewing existing literature in the field regarding open innovation in healthcare. The aim is to comprehend the application of open innovation in healthcare and its

advantages. The research aims to answer the following question: What are the benefits of OI to healthcare? There is currently limited research conducted on the topic, and studies analyzing the benefits of OI in healthcare fail to categorize them accordingly. Furthermore, although studies on healthcare innovations exist, there has been little attention paid to the link between open innovations and improved healthcare processes. Therefore, this paper identifies gaps in the current research and suggests some directions future studies should take. The paper aims to achieve this by comprehensively capturing the essence of this exciting field and its potential to redefine health care. The next section will present the literature review on the topic, research methods, and findings. The last part will finally conclude with some last thoughts about how open innovation might be able to revolutionize health care.

I. LITERATURE REVIEW

Open healthcare innovation has become a major topic over the past decade. Hence, substantial literature is available to describe the different aspects of this exciting phenomenon. For example, Liu et al. (2022) conducted a very in-depth study on the role of open innovation in technologies related to the COVID-19 pandemic in the UK and globally for the health industries. Their work has produced emergent themes, including crowdsourcing, social innovation, digitalization, platform innovation, modularity, design, technology exaptation, relationships, networks, and ecosystem dynamics. Further, this is from the work of Yeung et al. (2021), who conducted a bibliometric analysis of the scientific literature with open innovation regarding medical and pharmaceutical research in the health sector. They further identified the most influential authors, institutions, countries, journals, research areas, and recurring terms. North

America and Europe sourced most of the literature, publishing results in business and economics, pharmacology and pharmacy, and engineering journals.

There are several advantages to open innovation in the healthcare industry. Indeed, the 2015 World Economic Forum report elaborates that open innovation allows healthcare innovators to share risks, reducing the costs and time required for commercialization. Collaboration mechanisms with the government, industry partners, and academia also ensure the ability to avoid dead-end technologies and quickly identify potential research directions. Furthermore, Nesta (2017) noted that numerous open innovation programs aim to accelerate health innovation, reduce costs, better target identified areas of need, increase widespread adoption, and increase diffusion. In the published literature, the performance of open innovation in healthcare in terms of its scientific impact and ability to garner social media attention is largely unknown.

Bullinger et al. (2012) further examined the role of the public in pursuing the concept of open health as a research platform. This trend differs from the traditional model, in which healthcare professionals are the sole drivers of change. In their study, they observed that the supposed measures of open innovation, which involved patients, health workers, physicians, families, and public proponents, were highly effective in promoting positive standards of innovation and were extremely accepted by the viewers. It engages people in active use of the platform, where empathic support and information sharing are the most crucial components of communication. This paper presents preliminary research findings on the impact of OI practices on innovation and community support in healthcare. Dandonoli (2013) provided a comprehensive analysis that delved deeper into how OI could serve as a model for global health partnerships.

In a study, Yeung et al. (2021) analyzed the scientific literature on open innovation using bibliometric analyses. In these studies, Flessa and Huebner (2021) found that pharmaceutical and

biotechnological companies that frequently contributed to the analyzed publications had, on average, higher means of citation counts and social media attention. Also, Torab-Miandoab et al. (2021) systematically reviewed OI concerning the healthcare ecosystem. The authors observed a mild engagement in the healthcare industry, especially in the pharmaceutical research and health informatics domains. Their systematic review of 29 articles indicated that many experiments are still at the pilot or prototype level, which pinpoints the need for more studies to foster OI in healthcare.

Despite the widespread exploration of OI in healthcare research, there are some crucial gaps in its application. Another gap is the need for similarly infrequent and systematic reviews of OI in the context of healthcare, specifically about healthcare systems' protocols. Several earlier studies, like Bullinger et al. (2012) and Torab-Miandoab et al. (2021), have focused on different aspects of OI. However, no systematic reviews have gathered and compared outcomes from various healthcare settings, nor have they examined the effectiveness of OI within systematic protocols. Moreover, the need for such information complicates the understanding of how to precisely incorporate OI into the healthcare industry's, which includes creating and enhancing best practices underlying guidelines to implement in clinical scenarios, designing patient care trajectories, or developing health management systems. Several studies have focused on the applicability of OI in specific contexts, including the pharmacological and health informatics sciences; however, more recent studies have yet to analyze OI in diverse healthcare-related contexts. Thus, research in these areas would facilitate understanding the key activities, issues, and factors of OI's systematic application.

Despite the expansive nature of open innovation in healthcare research, there remain unfilled gaps. The existing literature clearly lacks exploration of various aspects of open

innovation in healthcare, often focusing on specific cases, technologies, or countries. Furthermore, the dynamic environment and constant changes in healthcare and practices associated with innovation require consolidating current technology. For this reason, this paper will concentrate on conducting a systematic literature review (SLR) of existing research on open innovation. It will also offer a comprehensive framework that summarizes the best practices for utilizing this concept to address the multifaceted issues the conventional healthcare industry is currently facing. An SLR will provide clarity and direction to the research outlines surrounding open innovation in healthcare. It will also offer empirically generated recommendations to policymakers, healthcare providers, and innovators who wish to leverage open innovation to improve health outcomes, reduce costs, and increase collaboration.

It is necessary to conduct a systematic literature review to gather more information about the effects of OI in healthcare by linking different findings to generate an exhaustive conclusion. The systematic literature review will provide a thorough review of literature associated with the research question and synthesize previous works to fortify the foundation of knowledge on OI innovation in healthcare. The systematic review will enable the collection of data from a variety of independent studies, enhancing the generalizability and reliability of the results. This is especially crucial when there is a substantial amount of research on a particular subject and one wishes to comprehend the broader context.

II. METHODOLOGY

The study conducted the systematic review and meta-analyses using the PRISMA 2020 model (Page et al., 2021), which employs systematic identification, screening, and selection of relevant studies on open innovation in healthcare.

1. **Search Strategy:**

The primary step in this systematic review was to identify studies. The paper performed this by conducting a comprehensive search of two online databases: Scopus and Web of Science (WOS). Ayo-Farai et al. (2023) suggested designing the search strategy to include a broad range of studies on open innovation in healthcare. Researchers created the research matrix by searching for terms related to open innovation and its benefits. These terms included "open innovation," "advantages," "impacts," "benefits," and "profits." Researchers conducted the search from the inception of open innovation (2003) to 2024.

The search strings used were as follows:

- Search String 1: "Open Innovation" AND "Healthcare" AND "Benefits" AND "Collaboration"
- Search String 2: "Open Innovation" AND "Medical Research" AND "Outcomes" AND "Patient Care"
- Search String 3: "Open Innovation" AND "Healthcare Systems" AND "Efficiency" AND "Digital Health"

2. **Selection Criteria**

A set of predefined inclusion and exclusion criteria guided the selection of studies.

The inclusion criteria were as follows:

- Publication of the study should span the period from the beginning of open innovation (roughly 2003) to 2024.
- The study should focus on healthcare-related subjects such as medicine, pharmacology, toxicology, pharmaceuticals, nursing, health professionals, immunology, and microbiology.

- The study should be an article. The researcher excluded other documents like books, book chapters, conference papers, reports, and letters.
- The researcher should write the study in English.
- The study should be open-access.

The exclusion criteria were as follows:

- Researchers excluded studies published before the inception of open innovation (before 2003).
- Researchers excluded studies that did not focus on healthcare-related subjects.
- Researchers excluded document types other than articles.
- Researchers excluded studies written in other languages.
- Researchers excluded studies that are not open-access.

3. Quality Assessment Methodology

A systematic review process typically includes a quality assessment to ensure the reliability and validity of the included articles. The current study conducted a quality assessment to ensure it met the inclusion criteria for analysis of high-quality research articles. We apply quality assessment criteria to the included articles, considering the study design. The criteria included sample sizes, methodology, data analysis techniques, and adherence to ethics in empirical studies. Da Silva Meireles et al. (2022) suggested that the methods of data collection, the level of analysis, and transparency in the presentation of the findings determine the rigor of qualitative studies. The researcher appraised theoretical studies based on the clarity of the theoretical framework, logical reasoning, and argument coherence.

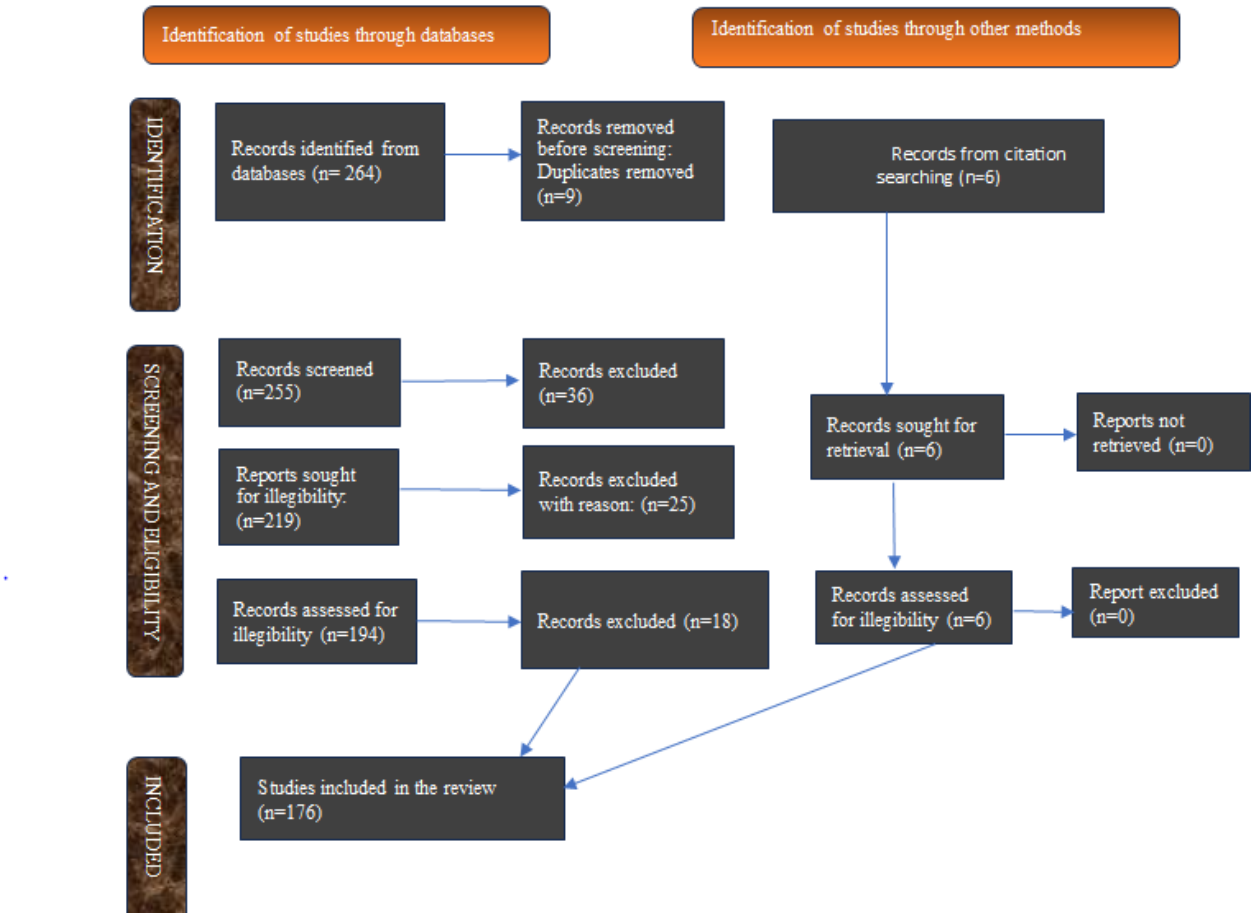

Figure 1: PRISMA Flowchart

4. Study Selection

Researchers searched the databases with no language restrictions, using Scopus and WOS, for studies that utilized open innovation in the healthcare setting while restricting the year of publication before 2003. The first search generated a total of 176 articles. The researcher also examined the reference lists of the articles identified in the review and conducted citation tracking. Thus, the researcher selected three more articles, increasing their number to 120, based on the indicated criteria and the results of their introductions.

Once the researcher collected the sources from the databases, 9 duplicates were excluded, creating the final set of studies. During this process, 255 articles that were deemed relevant to the subject for further screening. The next step was to screen the 255 outstanding titles and abstracts pertaining to open innovation in the healthcare sector. A mismatch in one or more screening criteria led to the exclusion of 36 articles, while other areas failed to capture the fundamental concept of open innovation. Eligibility was then sought for 219 articles. In this phase, 43 articles were removed because they either did not focus on open innovation or did not provide enough synthesizeable data. Finally, 176 articles from the databases qualified for assessment.

III. RESULTS AND DISCUSSION

1. Evolution of the Papers Overtime

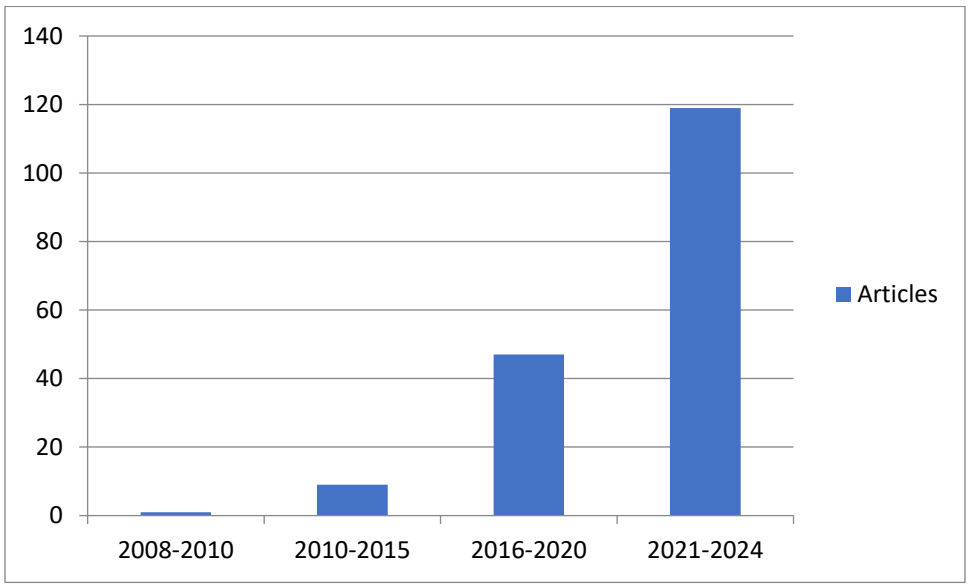

Figure 2: Evolution of Papers since 2008

Figure 2 shows that open innovation has been primarily considered in recent research. Of the 176 studies included in the review, only one was done within the first decade of the 21st century.

As the century progressed, studies on the benefits of open innovation started becoming more relevant, with a total of 9 studies being conducted between 2010 and 2015. The rising trend was also witnessed in the following five years, during which 47 studies were conducted between 2016 and 2020. However, the review presented that the benefits of open innovation in healthcare have been immensely considered in the last four years, where most of the articles used in this study (n = 119) have been conducted between 2021 and 2024. This shows that the results obtained from the review significantly present the trends and current status of the benefits OI poses to healthcare.

Worldwide Distribution of the Papers

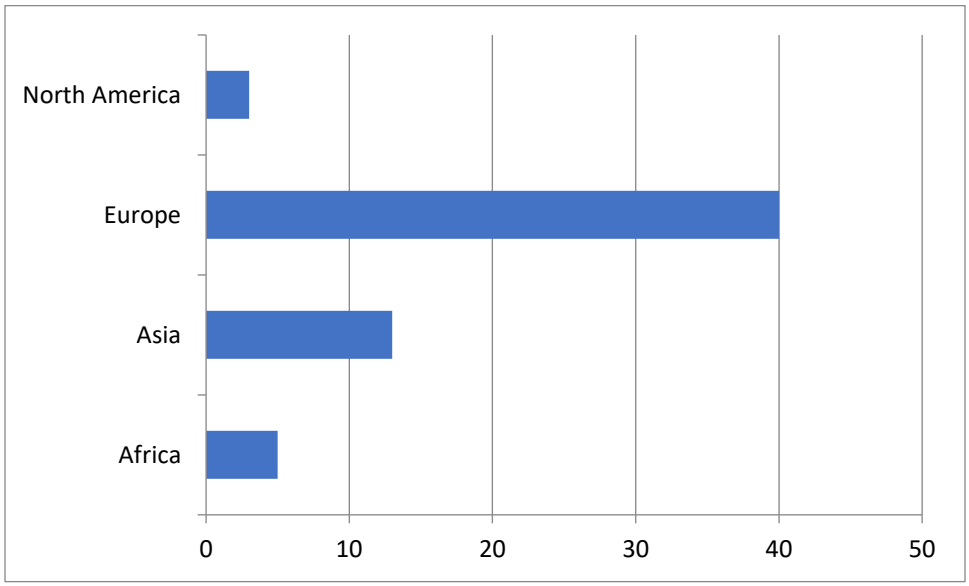

Figure 3: Worldwide Distribution of Reviewed Articles

From the studies that indicated their origin, Figure 3 shows that most of the studies on OI hail from Europe and Asia. The topic has attracted little attention in North America and Africa.

Identified Categories (See Appendix 1)

2. **Collaboration and community engagement**

This category includes programs that aim to get the public's support and participation in health services. It enhances the collaboration of various stakeholders, such as healthcare providers, users, researchers, and society. The goal is to encourage, share, and apply innovations sourced from various angles. Eight articles in this category place a strong emphasis on collaboration and communities. There is a growing awareness that open innovation, specifically in the healthcare industry, is becoming a social effort. Researchers recognize the need to implement and maintain innovative health interventions for human communities. Communities' involvement and partnerships with them are the best ways to achieve this. This focus stems from the realization that a single sector or composition cannot solve a variety of healthcare issues.

3. **Data security and privacy**

This category covers some of the most sensitive aspects of healthcare informatics, such as the protection of data and patient privacy, with two articles. It encompasses approaches and tools designed to protect the patient's data from unauthorized access, use, and compromise. Although only three articles fall under this category, it is essential as it summarizes Molyneux's arguments. Researchers can attribute the lack of research to the challenges and problems related to data confidentiality and privacy issues within the open innovation framework. As healthcare institutions transition to digitalization, the risk of data compromise increases. Including this category in the study shows the emerging ethical and legal concerns in data management in the health sector, especially about open innovation using information.

4. **Equity and inclusion in healthcare:**

This vertical primarily focuses on reducing healthcare disparity and ensuring that new-age health solutions are available to all, especially the marginalized. It includes promoting equity, reducing disparities, and increasing inclusivity in health care delivery. This category focuses on

equity and inclusion in healthcare, with moderate depth in two articles. It is considered to be a relevant subject. However, fewer studies have indicated that open innovation practices require further attention to implement these principles effectively. The articles in this category demonstrate the design and implementation of healthcare innovations that aim to address inequalities by improving access or quality of care across various healthcare sectors rather than unintentionally perpetuating them.

5. **Health and social impacts:**

This section evaluates healthcare innovation's overall impact on society and public health. It also examines new technologies, treatments, and models of care from a societal perspective to determine how they impact overall health outcomes. There are around two articles in this category, and their relevance to understanding the social impact of healthcare innovations is evident. Both researchers and those involved in the practice are interested in how innovations may benefit patient health and add to societal well-being. This suggests that the assessment of open innovation in healthcare might not just be based on its technical or economic merits but also on a focus on better human needs and public health challenges.

6. **Healthcare accessibility and affordability**

This category contains three articles exploring ways to design a more accessible and affordable healthcare system by decreasing costs, eliminating barriers to care, and enabling people from all over the population to access the services they need more quickly. Three articles in this category demonstrate the ongoing, significant efforts to remove economic barriers that hinder individuals from accessing necessary care.

This group of articles underscores the importance of not only advancing innovations but also ensuring their accessibility to those in need. The number of studies in this category seems

moderate, as it indicates that while the trends of making healthcare more affordable and accessible are recognized, more research and innovation work needs to be done to create solutions that work sustainably and are transferable to various healthcare settings.

7. **Innovative Solutions for Patient Care**

This category includes three articles that investigate new and innovative ways to improve patient care and outcomes, such as new treatments, care methods, or ways of engaging patients compared to the previous model. It features three articles illustrating the importance of innovative solutions in patient care delivery. The robust presence of this category reflects the healthcare sector's dedication to developing patient-centered care. This indicates that open innovation is considered capable of satisfying the needs and expectations related to patient care quality, daily clinical practice outcomes, and patients' experiences. This creates a patient-centered approach to driving the real purpose behind healthcare innovation: improving individual human beings.

8. **Process optimization in healthcare**

This vertical is all about enhancing healthcare processes and operational efficiency. This covers the science behind how innovation can eliminate steps in processes and reduce waste, leading to more streamlined healthcare delivery. Around three articles in this category indicate a significant interest in refurbishing healthcare processes, ultimately reducing costs. This emphasis on process improvement highlights open innovation in terms of more than developing new treatments or technologies but refining current systems and processes. Healthcare organizations must improve operational efficiency to provide better care at lower costs, an enterprise of growing importance when healthcare spending increases and demand for services intensifies.

9. **Public Health and Emergency Management**

Preparedness for public health threats and emergencies includes awareness of health pandemics, natural disasters (like tsunamis or earthquakes), and other large-scale theory-making on public health emergencies. It encompasses studies of emergencies, response, and recovery efforts. It may indicate the unique and specialized nature of public health and emergency management concerning healthcare innovation; however, only one article falls under this category. However, the fact that it exists at all speaks to the central role preparedness and response play in ensuring public health and safety in times of crisis. While researchers are exercising open innovation in response to emergency management readmissions, researchers may need to further explore and develop this area to ensure the resilience of healthcare systems during public health crises.

CONCLUSION

In this light, this systematic review examines the benefits that open innovation presents in healthcare by drawing from six studies carried out in dissimilar countries and healthcare settings. The results seem to indicate that open innovation may drive innovation in healthcare in relation to better communication, enhanced cost estimation, and value; organizational justice; governance; and communication improvement; all regarding innovation and patient-physician experience. The study also highlighted potential areas for future research, such as examining the innovation levels of one of the studied firms, introducing new health protocols, exploring other industry scopes, gathering more empirical evidence, and exploring other practices and strategies of outside-in open innovation.

An inclusion quality assessment showed that a wide span of design and methodology complexity exists in the research on open innovation in health care. However, these studies provide

a valuable understanding of the advantages that open innovation in healthcare can provide. Health care organizations can apply open innovation in practice to implement improvements in all major aspects of health care provision, from communication and collaboration to fostering a culture of innovation. However, achieving this requires appropriate planning, continuous support, and an openness to new approaches.

Generally, open innovation holds great potential for important payoffs in health outcomes and health care delivery. We need to conduct much more research to fully understand the benefits, challenges, and best practices of implementing open innovation in various health care settings. This systematic review contributes to the ongoing research efforts by comprehensively assessing the current state of open innovation in healthcare and identifying key areas for future research advancement. The work is bound to inspire further studies and practical initiatives for harnessing the power of open innovation to achieve healthcare for all.

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Appendix 1

Table for Benefits Categorization

Authors	Year	Collaboration and Community Engagement	Data Security and Privacy	Equity and Inclusion in Healthcare	Health and Social Impact	Health Technology Integration	Healthcare Accessibility and Affordability	Innovative Solutions for Patient Care	Process Optimization in Healthcare	Public Health and Emergency Management
Galbraith B.; Mulvenna M.; Martin S.; McGloin E.	2008							X		
Elg M.; Witell L.; Poksinska B.; Engström J.; mi Dahlgaard-Park S.; Kammerlind P.	2011							X		
Kitson A.; Powell K.; Hoon E.; Newbury J.; Wilson A.; Beilby J.	2013					X				
Salge T.O.; Farchi T.; Barrett M.I.; Dopson S.	2013							X		
Metz A.; Albers B.	2014	X								
Vredenburg J.; Bell S.J.	2014				X					
Banyte J.; Tarute A.; Taujanskyte I.	2014						X			
Black H.G.; Vincent	2014							X		

L.H.; Skinner S.J.										
Schweitzer F.; Rau C.; Gassmann O.; Van Den Hende E.	2015							X		
Erickson G.S.; Barken M.; Barken D.	2015								X	
Acheampong F.; Vimarlund V.	2016	X								
Paltved C.; Morcke A.M.; Musaeus P.	2016						X			
Fernandes S.; Cesário M.; Barata J.M.	2017	X								
Kassianos A.P.; Georgiou G.; Papaconstantinou E.P.; Detzortzi A.; Horne R.	2017	X								
Allen M.; Bergmann J.; Best D.; Birks J.; Bountra C.; Buchan A.; Collins G.; Faulkner S.; Ford G.; Geddes J.; Gray A.; Locock L.; Noble A.; Pugh C.; Sheehan M.; Smith J.; Stoten A.; Vincent C.; Wells G.; Whyte P.; Greenhalgh T.; Ovseiko P.V.; Fahy	2017				X					

N.; Shaw S.; Kerr P.; Rushforth A.D.; Channon K.M.; Kiparoglou V.										
Cassia F.; Cobelli N.; Ugolini M.	2017				X					
Jull J.; Giles A.; Graham I.D.	2017						X			
Montagni I.; Langlois E.; Wittwer J.; Tzourio C.	2017							X		
Teirlinck P.	2017							X		
Thakur M.; Boudewijns E.A.; Babu G.R.; Winkens B.; De Witte L.P.; Gruiskens J.; Sushama P.; Ghergu C.T.; Van Schayck O.C.P.	2017							X		
Page S.J.; Hartwell H.; Johns N.; Fyall A.; Ladkin A.; Hemingway A.	2017								X	
Osei-Frimpong K.; Wilson A.; Lemke F.	2018					X				
Molenaar J.; Korstjens I.; Hendrix M.; de Vries R.; Nieuwenhuijze M.	2018						X			
Dowie J.; Kaltoft M.K.	2018							X		

Moreau K.A.; Eady K.; Sikora L.; Horsley T.	2018							X		
Litovuo L.; Karisalmi N.; Aarikka-Stenroos L.; Kaipio J.	2019	X								
Leorin C.; Stella E.; Nugent C.; Cleland I.; Paggetti C.	2019				X					
Dahm M.R.; Brown A.; Martin D.; Williams M.; Osborne B.; Basseal J.; Potter M.; Hardie R.-A.; Li J.; Thomas J.; Georgiou A.	2019				X					
Grenha Teixeira J.; Pinho N.F.D.; Patrício L.	2019				X					
Christiansen H.; Bauer A.; Fatima B.; Goodyear M.; Lund I.O.; Zechmeister-Koss I.; Paul J.L.	2019					X				
Keeling D.I.; de Ruyter K.; Mousavi S.; Laing A.	2019					X				
Spinelli G.; Weaver P.; Marks M.; Victor C.	2019					X				
Moro Visconti R.; Morea D.	2019					X				

Lems E.; Hilverda F.; Broerse J.E.W.; Dedding C.	2019						X			
Hickman I.J.; Coran D.; Wallen M.P.; Kelly J.; Barnett A.; Gallegos D.; Jarrett M.; McCoy S.M.; Campbell K.L.; Macdonald G.A.	2019						X			
Handberg C.; Mygind O.; Johansen J.S.	2019						X			
Gillespie J.J.; Privitera G.J.; Gaspero J.	2019							X		
Kumar H.; Downward P.; Hodgkinson I.; Manoli A.E.	2019							X		
Hughes C.; Bernoth M.; Winkler D.	2019							X		
Pappne Demecs I.; Miller E.	2019								X	
van Tuin L.; Schaufeli W.B.; van Rhenen W.; Kuiper R.M.	2020	X								
Tõnisson L.; Kunz Y.; Kecorius S.; Madueño L.; Tamayo E.G.; Casanova D.M.; Zhao Q.; Schikowski	2020				X					

T.; Hornidge A.-K.; Wiedensohler A.; Macke A.										
Mueller S.; Soriano D.; Boscor A.; Saville N.; Arjyal A.; Baral S.; Fordham M.; Hearn G.; Le Masson V.; Kayastha R.; Kostkova P.	2020				X					
Ekblad S.	2020				X					
Cheng Q.; Shum A.K.Y.; Ip F.W.L.; Wong H.K.; Yip W.K.K.; Kam A.H.L.; Yip P.S.F.	2020				X					
Bonello M.; Morris J.	2020					X				
Curtis K.; Brooks S.	2020						X			
Rashid Y.; Tanveer A.; Shaukat Z.; Sadiq I.	2020						X			
Visconti R.M.; Morea D.	2020						X			
Frempong J.; Chai J.; Ampaw E.M.; Amofah D.O.; Ansong K.W.	2020						X			
Walsh E.I.; Chung Y.; Cherbuin N.; Salvador-Carulla L.	2020						X			
O'Connor G.E.; Cook L.A.	2020							X		

Enciso-Santocildes M.; Vidu A.; Gómez-Urquijo L.	2020							X		
Dumalanede C.; Hamza K.; Payaud M.	2020							X		
De Siqueira G.; Al Balushi A.	2020							X		
Brands B.; Chomtho S.; Suthutvoravut U.; Boey C.C.M.; Tang S.F.; Godfrey K.M.; Koletzko B.	2020								X	
Pavani C.; Plonski G.A.	2020								X	
Könings K.D.; Mordang S.; Smeenk F.; Stassen L.; Ramani S.	2021	X								
Sagoe D.; Johnsen B.; Lindblad B.; Normann T.A.J.; Skogvoll V.; Heierdal M.; Lauritzen F.	2021	X								
Fan MD.	2021	X								
Matheson E.L.; Smith H.G.; Amaral A.C.S.; Meireles J.F.F.; Almeida M.C.; Mora G.; Leon C.; Gertner G.; Ferrario N.; Suarez Battan L.; Linardon J.;	2021	X								

Fuller-Tyszkiewicz M.; Diedrichs P.C.										
Mandal H.	2021				X					
Leone D.; Schiavone F.; Simoni M.	2021				X					
Campagnaro C.; Di Prima N.; Ceraolo S.	2021						X			
Uttama N.P.	2021						X			
Bucknall TK; Hutchinson A.M.	2021						X			
Gardiazabal P.; Bianchi C.	2021						X			
Cluley V.; Radnor Z.	2021						X			
Ooms W.; Piepenbrink R.	2021						X			
Wale J.L.; Chandler D.; Collyar D.; Hamerlijnck D.; Saldana R.; Pemberton-Whitely Z.	2021						X			
Lenette C.; Johnston T.; Paramanathan J.; Poorun S.	2021						X			
Wigert H.; Fors A.; Nilsson S.; Dalenius K.; Golsäter M.	2021							X		

Nwaozuru U.; Tahlil K.M.; Obiezu-Umeh C.; Gbaja-Biamila T.; Asuquo S.E.; Idigbe I.; BeLue R.; Oladele D.; Muessig K.E.; Rosenberg N.E.; Ong J.J.; Musa A.Z.; Tang W.; Ezechi O.; Iwelunmor J.; Tucker J.D.	2021							X		
Ptack K.; Strobl H.	2021							X		
Baksi A.K.; Parida B.B.	2021							X		
Shirazi F.; Wu Y.; Hajli A.; Zadeh A.H.; Hajli N.; Lin X.	2021							X		
Darlington E.; Masson J.	2021							X		
Benjaminse A.; Verhagen E.	2021							X		
Ehn M.; Derneborg M.; Revenäs Å.; Cicchetti A.	2021							X		
Bonin S.; Singh W.; Suresh V.; Rashed T.; Uppaal K.; Nair R.; Bhavani RR.	2021							X		
Goss H.R.; McDermott C.; Hickey L.; Issartel	2021							X		

J.; Meegan S.; Morrissey J.; Murrin C.; Peers C.; Smith C.; Spillane A.; Belton S.										
Thørring Bonnesen C.; Aviaja Rosing J.; Pil Jensen M.; Kjær Wehner S.; Rich Madsen K.; Toftager M.; Due P.; Fredenslund Krølner R.	2021							X		
Dias S.; Gama A.; Maia A.C.; Marques M.J.; Campos Fernandes A.; Goes A.R.; Loureiro I.; Osborne R.H.	2021							X		
Suárez-Álvarez L.; Suárez-Vázquez A.; del Río-Lanza A.-B.	2021							X		
Windasari N.A.; Lin F.-R.	2021							X		
Egli V.; Mandic S.; Pocock T.; Narayanan A.; Williams L.; Clark T.; Spasic L.; Wilson A.; Witten K.; Smith M.	2021								X	

Lundell S.; Toots A.; Sönnerfors P.; Halvarsson A.; Wadell K.	2022	X								
Palm K.; Fischier U.P.	2022	X								
Popp J.; Grüne E.; Carl J.; Semrau J.; Pfeifer K.	2022	X								
Bateman S.; Arnold-Chamney M.; Jesudason S.; Lester R.; McDonald S.; O'Donnell K.; Owen K.; Pearson O.; Sinclair N.; Stevenson T.; Williamson I.; Kelly J.	2022	X								
Bhattacharya S.; Wainwright D.; Whalley J.	2022	X								
Ke X.; Zhang L.; Tang W.	2022	X								
Yang J.; Chesbrough H.; Hurmelinna-Laukkanen P.	2022				X					
Naramski M.; Szromek A.R.; Herman K.; Polok G.	2022				X					

Borelli J.L.; Russo L.N.; Arreola J.; Cervantes B.R.; Marquez C.M.; Montiel G.; Carballo J.; Avalos V.; Garcia J.; Bhatt I.; Torres G.; Leal F.; Guerra N.	2022				X					
Grüne E.; Popp J.; Carl J.; Semrau J.; Pfeifer K.	2022					X				
Novak M.; Drummond K.; Kumar A.	2022					X				
Smith G.; Dixon C.; Neiva Ganga R.; Greenop D.	2022					X				
Terry A.L.; Kueper J.K.; Beleno R.; Brown J.B.; Cejic S.; Dang J.; Leger D.; McKay S.; Meredith L.; Pinto A.D.; Ryan B.L.; Stewart M.; Zwarenstein M.; Lizotte D.J.	2022					X				
Rödl A.; Arlati A.	2022					X				
Rivera J.M.B.; Yousefi C.; Cheng C.L.; Norman C.D.; Legare J.; McFarlane	2022					X				

A.; Noonan V.K.										
Chen J.; Zheng W.; Jiang B.	2022					X				
Song H.; Chen S.; Yu K.	2022					X				
Terry A.L.; Stewart M.; Ashcroft R.; Brown J.B.; Burge F.; Haggerty J.; McWilliam C.; Meredith L.; Reid G.J.; Thomas R.; Wong S.T.; Van Hoorn R.	2022						X			
Brown L.R.; Williams A.J.; Shaw K.; Ozakinci G.; van Beusekom M.M.	2022						X			
Jamieson D.; Martin M.	2022						X			
Al-Emran M.; Islam S.; Harun A.	2022						X			
Vargas C.; Whelan J.; Brimblecombe J.; Allender S.	2022							X		
Pham T.-A.N.; Le H.N.; Nguyen D.T.; Pham T.N.	2022							X		

Santonen T.; Petsani D.; Julin M.; Garschall M.; Kropf J.; Van Der Auwera V.; Bernaerts S.; Losada R.; Almeida R.; Garatea J.; Muñoz I.; Nagy E.; Kehayia E.; De Guise E.; Nadeau S.; Azevedo N.; Segkouli S.; Lazarou I.; Petronikolou V.; Bamidis P.; Konstantinidis E.	2022							X		
Zengarini N.; Pilutti S.; Marra M.; Scavarda A.; Stroscia M.; Di Monaco R.; Beccaria F.; Costa G.	2022							X		
Maaløe N.; Housseine N.; Sørensen J.B.; Obel J.; Sequeira DMello B.; Kujabi M.L.; Osaki H.; John T.W.; Khamis R.S.; Muniro Z.S.S.; Nkungu D.J.; Pinkowski Tersbøl B.; Konradsen F.; Mookherji S.; Mbekenga	2022							X		

C.; Meguid T.; van Roosmalen J.; Bygbjerg I.C.; van den Akker T.; Jensen A.K.; Skovdal M.; L. Kidanto H.; Wolf Meyrowitsc h D.										
Klafke R.; Didonet S.	2022							X		
Liu J.; Gatzweiler F.; Hodson S.; Harrer-Puchner G.; Sioen G.B.; Thinyane M.; Purian R.; Murray V.; Yi X.; Camprubi A.	2022							X		
Nyirenda D.; Payesa C.; Ntaba J.; Mhango R.; Kingori P.; Parker M.; Desmond N.	2022							X		
Ochieng B.M.; Smith L.; Orton B.; Hayter M.; Kaseje M.; Wafula C.O.; Ocholla P.; Onukwugha F.; Kaseje D.C.O.	2022							X		
Dinia L.; Iannitti V.A.; Mangini F.; Di Lascio F.; Frezza F.	2022							X		
Wormdahl I.; Hatling T.; Husum T.L.; Kjus S.H.H.; Rugkåsa J.;	2022								X	

Brodersen D.; Christensen S.D.; Nyborg P.S.; Skolseng T.B.; Ødegård E.I.; Andersen A.M.; Gundersen E.; Rise M.B.										
Shirahada K.; Wilson A.	2022								X	
Martens M.; Wouters E.; Van Olmen J.; Klemenc Ketiš Z.; Chhim S.; Chham S.; Buffel V.; Danhieux K.; Stojnić N.; Zavrnik C.; Poplas Susič A.; Van Damme W.; Ir P.; Remmen R.; Ku G.M.V.; Klipstein-Grobusch K.; Boateng D.	2022									X
Dutta B.	2023	X								
Taccone M.S.; Baudais N.; Wood D.; Bays S.; Frost S.; Urquhart R.; Graham I.D.; Takacs J.	2023	X								
Stevenson K.; Puthussery S.;	2023	X								

Teschemacher L.; Engelhardt M.; Al Munjid R.; Castaner M.M.; Borde T.										
Kuoppakangas P.; Stenvall J.; Kinder T.; Lindfors J.; Talonen A.	2023	X								
Zapata-Restrepo J.R.; Longworth G.R.; Chin-A-Paw M.J.M.; Dall P.; Skelton D.A.; Morejón Torné S.; Giné-Garriga M.	2023	X								
Münter L.; Drachmann D.; Ghanem M.; Prinzellner Y.; Smits C.; Werner K.; Bulsink V.; Schwaninger I.; Van Velsen L.; Faber N.H.	2023	X								
Hempler N.F.; Fagt C.; Olesen K.; Wagner S.; Rasmussen L.B.; Laursen D.H.; Glümer C.; Nygaard M.; Willaing I.	2023	X								
Araújo L.; Fontoura S.; Cid-	2023	X								

Fernandez X.M.; Sousa L.										
Marshall-McKenna R.; Kotronoulas G.; Kokoroskos E.; Granados A.G.; Papachristou P.; Papachristou N.; Collantes G.; Petridis G.; Billis A.; Bamidis P.D.	2023	X								
McDaid D.; Park A.-L.	2023	X								
Singh D.R.; Sah R.K.; Simkhada B.; Darwin Z.	2023	X								
Anshari M.; Hamdan M.	2023	X								
van Wezel M.M.C.; Muusse C.; van de Mheen D.; Wijnen B.; den Hollander W.; Kroon H.	2023	X								
Carey N.; Abathun E.; Maguire R.; Wodaje Y.; Royce C.; Ayers N.	2023		X							
Chen E.; Bishop J.; Cozon L.G.; Hernandez E.; Sadeghzadeh C.; Bradley M.; Dearth-Wesley T.;	2023			X						

De Marco M.										
Klein Schaarsberg R.E.; Ribberink A.Z.; Osinga B.; van Dam L.; Lindauer R.J.L.; Popma A.	2023				X					
Kalbarczyk A.; Perkins S.; Robinson S.N.; Ahmed M.K.	2023				X					
Dufour I.; Arsenault-Lapierre G.; Guillette M.; Dame N.; Poitras M.-E.; Lussier M.-T.; Fortier A.; Brunet J.; Martin J.; Laverdure M.; Brousseau G.; Bergman H.; Couturier Y.; Quesnel-Vallée A.; Vedel I.	2023									
Dinkoksung S.; Pitakaso R.; Khonjun S.; Srichok T.; Nanthasamroeng N.	2023					X				
Böttinger M.J.; Litz E.; Gordt-Oesterwind K.; Jansen C.-P.; Memmer N.; Mychajliw C.; Radeck	2023					X				

L.; Bauer J.M.; Becker C.										
Mohr-Stockinger S.; Sanft S.J.; Büttner F.; Butenschön S.; Rennert R.; Säumel I.	2023						X			
Li J.; Li X.; Zhang C.	2023						X			
Wu C.H.-J.; Guttena R.K.; Atmaja F.T.	2023						X			
Eletxigerra A.; Caldeira A.M.; Kastenholz E.	2023						X			
Corr C.; Murphy N.; Lambe B.	2023						X			
Peek M.E.; Gottlieb L.M.; Doubeni C.A.; Viswanathan M.; Cartier Y.; Aceves B.; Fichtenberg C.; Cené C.W.	2023						X			
Banks A.; Saito R.; Berneche N.; Krocak J.; Porta C.	2023						X			
Garretsen H.; van de Goor I.; van de Mheen D.	2023							X		
Kalocsányiová E.; Essex R.; Fortune V.	2023							X		
Desselle M.R.;	2023							X		

Wagels M.; Chamorro-Koc M.; Caldwell G.A.										
Benjamins J.; Duinkerken J.-G.; den Hamer-Jordaan G.; Canfijn R.; Koster R.; de Vet E.; Haveman-Nies A.	2023							X		
Fang M.L.; Sixsmith J.; Hamilton-Pryde A.; Rogowsky R.; Scrutton P.; Pengelly R.; Woolrych R.; Creaney R.	2023							X		
Nalugga E.A.; Kukundakwe M.; Tibakanya R.; Tindyebwa E.; Baluku W.; Mulindwa K.; Asiimwe S.P.; Twimukye A.; Waitt C.	2023							X		
Willgoss T.; Escontrias O.A.; Scrafton C.; Oehrlein E.; Livingstone V.; Chaplin F.C.; Benivento M.; Chapman H.; Brooke N.	2023								X	

Morimoto Y.; Koga Y.; Kenzaka T.; Son D.	2023								X	
Åkerblom K.B.; Ness O.	2023								X	
Chebli P.; Adsul P.; Kranick J.; Rohweder C.L.; Risendal B.C.; Bilenduke E.; Williams R.; Wheeler S.; Kwon S.C.; Trinh-Shevrin C.	2023								X	
Kronsted Lund L.; Gurholt K.P.; Kaae B.C.	2023									
Metaragakusuma A.P.; Sakakibara M.; Arifin Y.I.; Pateda S.M.; Jahja M.	2023									X
Dutta M.J.; Kaur-Gill S.; Metuamate S.	2024	X								
Servais J.; Vanhoutte B.; Aguirre-Sánchez-Beato S.; Aujoulat I.; Kraus C.; T'Sjoen G.; Tricas-Sauras S.; Godin I.	2024	X								
Katsuda A.; Naito Y.; Ishihara T.	2024		X							
Martin G.P.; Desai A.; Zoccatelli	2024			X						

G.; Brearley S.; Robert G.										
Latif M.S.; Wang J.-J.	2024				X					
Mirza U.J.; Stassen W.; Christie S.A.	2024				X					
Udoh M.O.; Mian Z.; Anakwenze L.; Okeke C.; Ziegler C.; Sawning S.	2024					X				
Fang J.; Lee V.C.S.; Wang H.	2024					X				
Nidam Y.; Gibson R.; Houston-Read R.; Picard M.; Gavin V.	2024					X				
Mac Fadden I.; Cocchioni R.; Delgado-Serrano M.M.	2024					X				
Yasobant S.; Bhavsar P.; Lekha K.S.; Patil S.; Falkenberg T.; Bruchhausen W.; Saxena D.	2024					X				
Dionne K.-E.; Carlile P.R.	2024						X			
Daniele G.M.; Medoro C.; Lippi N.; Cianciabella M.; Magli M.; Predieri S.; Versari G.; Volpe R.; Gatti E.	2024						X			
Main C.; Haig M.;	2024						X			

Chavez D.; Kanavos P.										
Owens J.S.; Exner-Cortens D.; Cappella E.; DeShazer M.; May N.; Seipp J.; Claussen C.; Zieg N.; Garcia M.	2024							X		
Haufe M.; Leget C.; Potma M.; Teunissen S.	2024							X		
Raeside R.; Todd A.; Sim KA; Kang M.; Mihrshahi S.; Gardner L.A.; Champion KE; Skinner J.; Laranjo L.; Steinbeck K.; Redfern J.; Partridge S.R.	2024							X		

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