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Development and Validation of an Innovation Culture Scale for Medical Centers: A Mixed-Methods International Study

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Abstract

Background: Innovation in medical centers transforms ideas into products or services that improve health outcomes, patient experience, and staff well-being. Healthcare systems worldwide face persistent challenges, including care quality and safety, workforce and resource shortages, staff burnout, a need to improve patient-centered care, unequal access, and rising costs. Innovation can help address these challenges, but medical centers need a measurable culture that supports the development of new products, services, and operational approaches.

Purpose: To identify the categories shaping innovation culture in medical centers from the perspective of innovation leaders, develop and validate a reliable assessment questionnaire, and provide recommendations for healthcare leaders and policymakers seeking to foster innovation.

Methods: This study integrated qualitative and quantitative methods. The qualitative stage was aimed at obtaining in-depth insights into innovative culture in medical centers, based on interviews with 16 innovation leaders working in international medical centers. Analysis started with an open inductive analysis, using a conventional content analysis and continued with deductive approach in directed content analysis. The findings were used to develop an innovative culture questionnaire. The questionnaire reliability was tested using exploratory factor analysis from data obtained from 126 clinicians and managers from 25 international medical centers.

Results: We found nine categories with twenty-one items that were loaded on 3 categories: organic innovation and entrepreneurship, resources and open innovation, rewards and incentives. The internal consistency of the survey was assessed with Cronbach's alpha, which indicated excellent to acceptable reliability of the survey items.

Conclusions: The study produced a reliable questionnaire that enables healthcare leaders and policymakers to assess innovation culture in medical centers and make informed investment decisions to strengthen it.

Research limitations: The sample size was insufficient to conduct Confirmatory Factor Analysis.

Practical implications: Assessing innovation culture enables healthcare leaders and policymakers to compare performance over time and across medical centers, identify strength, establish improvement priorities, and support the development of new products and services. At the national level, aggregated results can guide innovation policies related to funding, regulation, procurement reform, commercialization pathways, and public- private partnerships**.**

Trial registration: 1568-24-SMC**.**

INTRODUCTION

There is a dire need for innovation in healthcare to deal with the immediate global challenges healthcare is facing, among them patients' safety, quality of care, patients' centricity, workforce shortage, staff burnout and rising cost [1, 2]. Innovation can address these challenges, drive long-term healthcare transformation, and stimulate economic growth [3, 4]. Policymakers increasingly view innovation as a means of developing new solutions and enhancing health-system value, yet system-wide transformation remains slow and fragmented [5]. In Canada, for example, most key recommendations from the federal Advisory Panel on Healthcare Innovation remain unrealized a decade after its landmark report [6, 7]. Meanwhile, healthcare spending across Organization for Economic Co-operation and Development (OECD) countries has continued to rise [8], while patient safety indicators have stagnated or declined despite greater awareness and targeted investment [9]. Healthcare systems at national and local levels therefore need tools to implement innovation at scale, monitor progress, and align implementation with incentives.

Innovation is a key factor in human progress, influencing economic growth, productivity, and job creation. As such, it is a complex concept with no universally accepted definition in science, despite being the subject of many studies [10–13]. Innovation can be defined as the generation of a new idea and its implementation into a new product, process or service, leading to the dynamic growth of the national economy and the increase of employment as well as to the creation of profit for the innovative business enterprise [13]. Innovation is essential for businesses seeking to build a lasting competitive advantage and achieve success [14, 15].

When senior innovation executives in organizations were asked about the ranking of innovation in their company's priorities, 83% of respondents indicated that their companies rank innovation among their top three priorities [16], which underscores its impact on economic growth, but only 3% of the companies declared their innovation readiness. Previous studies have found that one of the most important constructs driving innovation success is the level of innovation culture within a particular company [17, 18]. These studies concluded that the most innovative companies are those that have created appropriate cultures that prioritize innovation. It was found that companies that build innovative culture are 60% more likely to be innovation leaders [19].

Innovation culture can be defined as a set of shared assumptions, values, beliefs, attitudes, and behaviors of organizational members that facilitate the creation and development of new products, services, or process innovations [20]. To continuously innovate, the organization needs a well-defined and measurable innovative culture that can foster creativity and the development of new products, services, and methods of production [21].

In healthcare, that depends on continual discovery and continuous improvement, innovation plays an even more crucial role. Innovation in healthcare can improve products, technologies, services and care delivery that can improve treatment, diagnosis, education, prevention, and access to healthcare [22, 23]. One of the most important elements to respond to emerging challenges with innovation is to promote a creative and innovative culture in health organizations, to allow the stakeholders to find solutions

focused on the healthcare systems' real needs [1]. Culture of innovation in medical centers involves shared beliefs that encourage improvement, resources that support innovation, and acceptance of change [24].

While innovation is recognized as an important capability for healthcare organizations, research on innovation in public healthcare is relatively limited compared to other sectors [25]. There are specific challenges associated with fostering a culture of innovation in medical centers, as public healthcare organizations are not typically perceived as having a culture that promotes innovation [26]. Public hospitals tend to resist organizational change, as entrenched organizational cultures, the dominance of health professionals, and political governance interact to create a bias toward inaction [27]. The profession of medicine is seen as risk-averse, given the nature of risk for human health that is inherent to the system. As a result, healthcare organizations often emphasize confirmatory practices and consistency in their culture [28], which may conflict with innovation [29]. Healthcare organizations rightly underline patient safety culture [30, 31], whereas innovation and entrepreneurial culture received less attention. Furthermore, healthcare organizations were traditionally viewed as passive recipients or implementers of innovation, rather than active contributors to its development [32–35].

In recent years, there has been a significant increase in the number of innovation centers within academic medical institutions and health systems [3, 36]. These centers aim to enhance clinical value by employing various commercial strategies; some focus on creating spin-off companies while others emphasize internal transformation [3]. Moreover, certain medical centers have introduced clinical entrepreneurship programs designed to assist clinicians in developing innovative solutions to specific issues identified through their frontline experiences, presenting some commercialization opportunities with potential financial benefits [37, 38].

Acknowledging the importance of fostering a culture of innovation within medical centers and assessing it, we aimed to develop a standardized survey to evaluate the innovation culture in these institutions, like the widely utilized patient safety survey [39]. We could find only a few studies that originated from a healthcare setting. Most of the studies in healthcare used innovative culture dimensions taken from other sectors, that were validated in general organizations. For more than 30 years, researchers have developed various scales to assess innovative culture in organizations [40–44]. Innovation culture is viewed as multi-dimensional, encompassing intent, infrastructure, behaviors, value orientation, and an environment conducive to innovation [43].

Research on metrics for innovative culture in medical centers is limited and often relies on tools adapted from other fields, resulting in overlapping dimensions and inconsistent outcomes. A recent study [45] adapted Dobni's innovative culture construct for healthcare organizations, as the model became the most referenced innovative culture construct [42]. This study aimed to address critiques that previous models were not specific to healthcare, although it found the results less robust than other established models. A work from UK outlined 27 items under seven dimensions that influence innovative culture in medical centers: risk-taking, resources, knowledge, goals, rewards, tools, and relationships [46]. These

items and dimensions were derived from literature, adopted from other industries. While experts validated the survey, its reliability was never tested.

Despite the availability of various metrics for assessing innovation culture across different organizations, including in healthcare, we could not find one universally accepted tool that is used in medical centers today. The studies that focused on medical centers settings did not refer to entrepreneurship and commercialization at all. While the study from the UK [46] provided a foundation for understanding the dimensions that influence innovative culture in medical centers, we aimed to identify which dimensions remain relevant today, determining if there are new categories and items that should be considered and validate the findings.

Assessing innovation culture can help healthcare leaders and policymakers' direct investments, improve products and workflows, reduce costs and delays, and address persistent challenges. As health systems establish innovation agendas, the main policy question is how to make innovation a sustainable driver of transformation across organizational and national levels [5].

METHODS

Our study followed the exploratory sequential mix methods type [47], when qualitative data were collected and analyzed first, to obtain in-depth insights into innovative culture in medical centers and then quantitative data were collected and used to test the findings empirically across larger populations. The study was divided into three parts. At part one, the qualitative stage, we identify an inventory of the categories and items that shape the innovation culture in a medical center. At part two, the categories and items that were discovered at stage one allowed us to develop a questionnaire that would assess the innovative culture of medical centers. At part three of the research, we used quantitative analysis to test the resulting questionnaire for reliability and validity, based on data collected from 126 questionnaires. The testing was necessary to ensure that this instrument is both consistent and accurate in assessing the innovation culture in a medical center.

Setting

The data for the three parts of this study were obtained through ARC's global network for medical innovation. ARC, short for Accelerate, Redesign, and Collaborate, is a global innovation platform that originated at Sheba medical center. The ARC network includes international medical centers, academic institutes, industry partners and startups, with the goal of developing, piloting, and launching new solutions for both transformation as well as economic growth [38, 48].

Part 1- Qualitative Stage

Sample

The data for the qualitative research were obtained through semi-structured interviews with 16 innovation managers working in medical centers. The interviewees were purposefully selected to capture a range of outcomes, representing the views of innovation managers from various countries and medical centers of different sizes (bed capacity) and types (9 public hospitals, 6 private nonprofit hospitals, and one private for-profit hospital). The resulting sample included innovation managers (9 male and 7 female) from 8 countries: United States (5 participants), Canada (4), Israel (2), Brazil (1), Australia (1), Germany (1), France (1) and Sweden (1). Most of the innovation leaders (12) in this study came from large medical centers, with more than 450 beds [49], 2 from medium-sized medical centers (250–449 beds) and 2 from small (1-249 beds), specialized medical centers. Most (15 out of 16) of the healthcare institutions were academic medical centers. The participants' profiles are detailed in Table I.

Table I - Innovation leaders' profiles

Participant	Gender	Medical Center Size (Number of beds)	Academic Medical Center Yes /No	Public/ Private Medical Center	Country
P1	Male	Large size (1400 beds)	Yes	Public	Canada
P2	Female	Large size (1040 beds)	Yes	Private Nonprofit	US
P3	Male	Large Size (900 beds)	Yes	Private Nonprofit	US
P4	Female	Large size (1040 beds)	No	Private Nonprofit	US
P5	Male	Small Size (240 beds)	Yes	Private Nonprofit	France
P6	Female	Large Size (900 beds)	Yes	Private Nonprofit	US
P7	Male	Large size (> 1000 beds)	Yes	Private For-Profit	US
P8	Male	Medium size (305 beds)	Yes	Public	Israel
P9	Male	Large size (1300 beds)	Yes	Public	Canada
P10	Female	Small Size (160 beds)	Yes	Public	Australia
P11	Female	Large size (1600 beds)	Yes	Public	Sweden
P12	Male	Large Size (800 beds)	Yes	Public	Canada
P13	Male	Large Size (500 beds)	Yes	Private Nonprofit	Brazil
P14	Male	Medium (300 beds)	Yes	Public	Canada
P15	Female	Large size (3000 beds)	Yes	Public	Germany
P16	Female	Large size (1300 beds)	Yes	Public	Israel

Data collection

The first author conducted interviews via Zoom between October 2023 and February 2024, with an average duration of 45 minutes. The initial 35-minute segment aimed to gather participants' perspectives

on definitions of innovation and the culture of innovation in medical centers, as well as the categories influencing an innovative culture. During the second, 10-minute segment, participants were asked to provide their perspectives on the seven dimensions identified by Maher et al. (2010) [46]. These dimensions include relationships, risk-taking, tools, resources, knowledge, goals, and rewards, along with the components that constitute these elements.

Two pilot interviews were conducted in August 2023. The data from the pilot interviews were not added to the final analysis. The final interview guide can be found in supplement 1.

With the participants' consent, the interviews were video- and audio-recorded. The interviews were transcribed verbatim with Transkriptor software. Additionally, notes taken during and immediately after each interview enabled us to document the interviewees' non-verbal reactions.

Data analysis

Analysis started with an open inductive analysis, using a conventional content analysis [50], for the first part of the interviews, with categories and names for categories deriving from the data, in five steps. Step 1- The first author (OB) read all the data repeatedly to familiarize herself with the data and obtain a sense of the whole. Step 2- The data was read word by word to drive codes, by highlighting the exact words from the text that appear to capture key concepts. Step 3- Notes of first impressions were made with thoughts and initial analysis. Labels for codes emerge. Step 4- The second author (AF) read the notes and codes and added her suggestions. Step 5- Codes were sorted into categories, based on how they are related and linked.

While reviewing the categories, the first author recognized most of them can suit the titles given by Maher *et al*. 2010, so from this phase and for the second part of the interviews, we used a deductive approach in directed content analysis, using the seven dimensions that were found by Maher as the titles for the final categories [46]. The emerging coding and categories were discussed throughout the process with the other authors. Data analysis continued until saturation of the research topic was achieved [51, 52], when no further categories that influence innovative culture were identified. Any uncategorized text received new codes that were later analyzed for potentially new categories. All co-authors reviewed the final categories and items to refine classification. The findings were also reviewed with seven innovation leaders, and their feedback led to some changes.

Trustworthiness

(1) For consistency and credibility of data collection, the interviews were conducted by a single interviewer (OB), using the same interview guide for all the interviews, followed by a thick description of the data that was collected, accompanied by reflective conversations with the second and fourth authors to reach agreement on the codes sorting, to enhance credibility [53, 54] (2) To enhance credibility, the data was analyzed by the one of the authors (OB), who is familiar with the research subject and reviewed by the second author (AF), who is well experienced with qualitative research methods and discussed

with the two other authors, who are well familiar with the research subject, and have vast experience in health research, benefiting from the team's diverse experience and reaching a consensus, utilizing triangulation [54]. (3) To enhance transferability, the participants were chosen from various countries and types of medical centers to contribute to a richer variation of the phenomenon of innovative culture in medical centers [53]. (4) To strengthen transferability, quotes were used to illustrate the results [53, 54]. (5) To enhance credibility, seven innovation managers, including three interview participants, reviewed the qualitative findings through member reflection [54].

Part 2 – Questionnaire

A draft questionnaire was developed based on the interview analysis at the qualitative findings, to assess the innovative culture among clinicians and managers in international medical centers. The questionnaire contained 30 items measured on a 5-point Likert scale, with response options ranging from 1 'strongly disagree' to 5 'strongly agree' [55]. We also included an open question asking if there are other factors that influence the innovative culture and were not mentioned. Five additional questions sought to collect the respondents' demographics and their professional status (i.e. physician, nurse, etc.). Finally, the questionnaire included also five descriptive questions to assess various characteristics of the medical center.

Part 3- Quantitative Stage

The quantitative stage of the study aimed to develop a questionnaire designed for assessing innovation in medical settings, to further reduce the number of items and evaluate its reliability.

Sample

The sample was purposefully selected to represent the views of clinicians and managers in international medical centers. The selection was based on such criteria as (1) clinicians (i.e., physicians, nurses) (2) managers (i.e., middle managers, senior managers, C-level managers), (3) understanding English.

Data collection

The questionnaire was uploaded to Qualtrics, and the link was electronically distributed to 25 innovation leaders working in medical centers in 8 countries, with the request to fill it out and share with clinicians and managers at their medical centers. A bigger sample allowed us to check the survey reliability using Cronbach's alpha. Responses to the questionnaire were collected between September 2024 and December 2024.

Data analysis

Statistical analysis included Exploratory Factor Analysis (EFA) and internal consistency (Cronbach's alpha coefficient) for the total questionnaire and each factor. Statistical analysis conducted using SPSS

V23. Exploratory factor analysis (EFA) is usually one of the first steps in the process of building a new questionnaire. It is commonly used to group items into the smallest number of clusters (i.e., factors) that will account for the highest variance [56] based on a shared or similar theme.

Prior to EFA, a multi-collinearity assessment was conducted between the 30 items. Items that correlated less than 0.4 with all other items or items that correlated > 0.8 with one or more other items were removed [57, 58]. The decision of which of the two correlated items to remove was based on the proportion of variance explained by each item (the item's 'communality statistics'). Items with higher communalities were retained. EFA (n = 126) was thus performed on a pool of 27 prospective items which remained following the correlation assessment described above. Principal Axis Factoring (PAF) and Orthogonal Varimax Rotation were used in several runs; each run led to the removal of one or more items. Items that had double (or more) loading and items that had similar meaning (prototypic items correlated with each other above r = .80) were removed. After each item's omission, the analysis was rerun and the rotated structure examined. Iterations were stopped after no double loadings were evident. All factors with eigenvalues greater than 1.0 were retained and the Scree Test, which presents the percentage of variance explained, was assessed to verify the total number of factors to retain.

Internal consistency

Assessing the internal consistency of items loaded onto the same factors, as well as that of the whole questionnaire conducted using Cronbach's Alpha to verify that the item grouping established in the EFA step still holds.

Ethics

The Ethics Committee at Bar-Ilan University (the first and fourth authors' institution) approved the study. Approval was also obtained from the Helsinki committee (The IRB, Institutional Review Board) at Sheba Medical Center (the third author's institution, SMC-1568-24). The participants in the interviews signed a consent form. All names and personal details were kept confidential. The participants who filled out the questionnaire read a declaration that the completion of the questionnaire constituted informed consent, thus agreeing to take the survey. Participation in the study was voluntary and not rewarded.

RESULTS

Qualitative results

1. Categories shaping the innovative culture (item generation)

Upon analyzing the qualitative data, we could recognize ten categories that shape the innovation culture, including (1) leadership, (2) innovation methods (tools) and process, (3) risk-taking, (4) internal relationships, (5) goal setting, (6) knowledge (7) resources, (8) collaborations with external partners, (9) rewards, and (10) regulations. Each category consisted of a few sub-categories or items. Figure I

summarize the key categories and sub-categories (items) that shape the medical center's innovation culture according to the participants.

Figure I. Categories and Items (sub-categories) shaping the innovation culture in medical centers

Source: Authors own work.

* The items "Revenue" and "Reduce costs" under goals were removed after discussions with the authors and seven innovation leaders.

1. **Leadership**

According to the participants, leadership buy-in was the leading and most significant category for innovative culture in medical centers, setting the vision and promoting a culture of continuous improvement. According to the participants, when the leadership is setting innovation as a high priority, it provides all the support that is needed, setting the goals, providing resources and encouraging risks taking.

"The goals, resources and risk taking, a lot of that comes from the leadership element." (P7)

"Leadership might be the most important thing. This means that someone must set the tone and universe the right vision and lead after it." (P11)

The position of executive innovation leader was acknowledged as essential for supporting innovation and showing the importance to the organization.

"Number one, there has to be a leader that is willing to champion it …, make it a priority". (P7)

"It says this is important to the organization, to actually give an executive director role was really important because it actually showed the organization that this is actually an important strategic enabler." (P10)

The participants recognized shared leadership and involvement of middle management as important, because those managers are the ones that will deliver the strategy to their subordinate employees and execute the tactics to achieve the goals for innovation, while giving their insights along the way.

"...of shared leadership. You cannot just have a manager, one leader having a vision and that's all, and everybody must execute. So, you have to share the leadership regarding innovation with … your middle management and even with the people (who) are executing… because they are the best ones to give you insights." (P5)

One participant mentioned the challenge of managers who don't empower their employees to be innovative, which might inhibit the innovation in a medical center.

"… not all managers want to empower their employees to be innovative." (P12)

The participants suggested recognizing ambassadors for innovation or influences among the clinicians and other employees; to disseminate innovation throughout the organization. These ambassadors are usually passionate about innovation, practice it and might influence others to follow.

"…finding those ambassadors for innovation or for change." (P1)

" Innovation is challenging...what you do is you go with the ones who want to do it. I call them the influencers." (P2)

2.2 Innovation Methods (tools) and processes

Tools for innovation, like design thinking and lean methods, were mentioned by the participants as influencing the innovative culture and allowing the staff to use the methods on their own to improve the current situation.

"All the leading hospitals already are working with lean tools, to improve internal innovations." (P4)

"One of the teams is what we call the health design lab essentially where … we concentrate all the designers, the bio designers, the design thinkers or service designers, you know the people that could be health professionals or not, but people that really understands how design works and how design is important for innovation". (P12)

The participants mentioned the importance of having processes for innovation, which includes identifying problems, generating and filtering new ideas as solutions, registering patents, developing and testing prototypes, determining which products or services go to scale and leading commercialization efforts for implementation.

"Innovation starts with chaos, but you have to have some consistency in the process to introduce new approaches." (P1)

The participants mentioned it is important to know who to reach out to with new innovative ideas at the medical center, as part of the process for innovation, to be able to get the tools and resources to execute the idea quicker and easier.

"...the operators or clinical leaders …they should know who to go to…" (P4)

"When you know who is responsible for this and this and who could help me for that and that…maybe things would be a lot quicker and easier if you already knew ... whom to ask if you have a certain problem and who could help you further." (P15)

Additionally, managing data and leveraging it for decision support was highlighted by the participants as an important tool to support innovation and decision making in medical centers. They mentioned technology as a tool to enable innovation.

"Being data-driven and fact based is always going to be very important." (P7)

"Value-based healthcare… it's all data-driven, is it? Data is the king." (P12)

Several participants stressed the importance of promoting the innovation center and its services, as well as publishing the achievements to engage internal and external partners.

"Internal marketing… I call it innovation implementation…. People get to know us. We meet all the words systematically. There is also external exposure. I work that people will get to know us." (P8)

"The innovation center should internally promote itself so people will know who to reach out to." (P16)

2.3 Risk Taking

Most of the participants said that risk-taking is essential for fostering an innovative culture in medical centers, challenging the status quo and encouraging new ideas and approaches. While risk-taking was mentioned as a critical component of fostering innovative culture in medical centers it was also mentioned as a factor that might be challenging in medical centers, due to the conservative nature of the clinicians that are trained to practice evidence-based medicine and averse to taking risks, to avoid causing harm to patients or disruptions to the organization. The participants mentioned that with the uncertainty and lack of clarity in healthcare today it is important to take some risks.

"Healthcare is in a period of a lot of uncertainty and lack of clarity of how we're going to conduct ourselves over the next 10 and 20 years...so we have to be willing to take chances and try new things." (P3)

"Clinicians... are trained to be averse to innovation. They are trained to be evidence based. They're trained to be using devices and therapies that have been proven to work. They're trained not to experiment with things in their work with their patients." (P6)

The participants emphasized the importance of creating a safe environment where trying new things is encouraged and supported, and it is safe to make mistakes.

"... in a hospital … you're not allowed to make any mistakes on patients or with patients. So that's a mindset we must change … what people are working on is challenging the status quo." (P15)

2.4 Internal Relationships

Internal relationships were mentioned as important to keep a transparent and honest discussion to promote innovative ideas. Employees should feel safe to bring up new ideas and give honest feedback.

"… relationships definitely is also one of the big ones [category that influence innovation culture]." (P15)

Trust emerged as a foundational element of relationships within the medical center, creating an environment where new ideas can be freely shared and explored without fear of punishment and humiliation:

"I think trust is incredibly important in this as well …. and ability to be vulnerable and making it a safe space to try new things." (P7)

Relationships that are based on diversity of opinions were mentioned as beneficial to generate more original ideas.

" With diversity of opinion … you get a better product and decision-making." (P3)

Another aspect the innovation leaders mentioned was the importance of openness and patience to allow innovative culture.

"...openness, openness and patience [are factors that influence the innovative culture]." (P11)

Some of the barriers for innovation that were mentioned are ego, pride and the disparity between different generations, with different work ethics, that might inhibit collaboration and innovation.

"There is a lot of pride and ego in medicine…the number one barrier to innovation is a belief that you're excellent and an inability of leaders (to) create a certain platform for people to try new things…someone else has come up with this idea and that it's like somehow threatening their own belief system…"(P1)

"I see generational challenges…the disparity I think between the cultures of those that are just coming out of college, those who have been out and worked a little bit and then those who are in the older generations is very different in terms of work ethic." (P2)

2.5 Goals

Setting measurable goals for innovation that are aligned with the medical centers' strategy were mentioned as encouraging innovation culture in medical centers. The main goals that were mentioned were achieving better patient outcomes and care, generating revenue, reducing costs, and attracting top talent and patients. Innovation was also mentioned as a way for hospitals to differentiate themselves.

"The first goal of a medical center is to be good at providing medical services and innovation is one way to do it, because it keeps you up to date with the best top technology and allows you to collaborate with the industry and this way you can bring better medical products to your patients." (P8)

"Another goal is to attract employees and the best physicians, especially the young guys." (P8)

"Innovations that actually improve cost."(P9)

"You have to differentiate yourself by other ways and I think that's a very pretty good way to differentiate, do innovation." (P5)

According to the participants, the goals should be clear and include metrics and key performance indicators (KPIs) to measure the medical center's performance. The participants mentioned the implementation of innovation as deliverables, at a reasonable time.

"It is very important to have a vision. To be clear. Where are we headed? What's the way? What do you want to do?" (P11)

"The translation of this vision into key indicators in a more strategic point of view… having these turn into real deliverables."(P13)

Some medical centers focus on commercializing innovative ideas, while others focus on internal transformation.

"Changing that mindset that actually having physicians that know what's needed, develop it, invent it, protect the IP, commercialize it and sell it is really the cycle of innovation." (P9).

"We do not work in commercialization at all. …Our internal organization never takes things out, so we invest in ….what is required for the transformation itself, to bring things into the organization." (P11)

One participant referred to how the organization structure is determining the medical centers goals for innovation, when she distinguished between a clinical or an administrator leader, who focuses on different goals in the medical center.

"I think that every single medical center approach innovation very differently…in terms of how the administrators or the executives who hold the titles with the words innovation, who they report to… reporting structure is often times defines their goals…. I think also some of it is, are you an institution that is run by clinicians or are you an institution that's run by administrators." (P4)

Two participants emphasized the importance of fast action in driving innovation.

"...One of my principal mistakes was that I didn't move faster and more aggressively with the things that you're doing….the world and the rest of healthcare is not going to wait for …. to get their act together." (P3)

"Sometimes urgency can be a good factor in fact urgency emergency it's good way to go through all the change."(P5)

2.6 Knowledge

According to the participants, medical centers should provide training programs focused on innovation and entrepreneurship to educate the staff and equip them with the skills and mindset needed to drive innovative initiatives:

"One of our goals [as an innovation center] is education for innovation." (P16)

"Innovation is like a profession. You need to learn a language: what is an entrepreneur? a patent? an accelerator? … How you take an idea and make it a product is a language that needs to be learned." (P8)

Few participants mentioned the role of learning organization for innovative culture, to encourage its members to continuously learn, share knowledge, adapt to changes and foster a culture where people

work together to solve problems, innovate, and improve overtime by transformation.

"Like when you read about these people who have looked at transformations within industries, it's often about creating a platform by which people are able to learn…second or third order learning within organizations and my sense is that healthcare is very much focused on this first order learning … a very simplistic view, as opposed to thinking about some of the deeper issues that are embedded within the culture." (P1)

"[Innovation culture is about] organizational behavior and organizational learning." *(P2)*

2.7 Resources

Participants emphasized the need for a dedicated budget for innovation. They suggested funding could come from different sources, such as philanthropy.

"You have to have the resources to do innovation. I think philanthropy is an important part about influencing innovation culture. Philanthropy allows you to do those high-risk high reward type of investigations or experiments….philanthropy can create… help the innovation culture and again reporting back on your success helps them to continue to feed…"(P9)

"There has got to be a dedicated budget for innovation, if the management would like to lead the domain." (P14)

Participants from public hospitals highlighted the difficulty of justifying innovation spending due to limited budgets and the risk of failure.

"We are not funded for infrastructure and innovation such as these… we are an activity based funded organization as a public hospital...we are only funded for clinical care activity that we deliver. So that is fundamentally the biggest challenge." (P10)

"...culturally getting these failures, especially when we commit money and then the money doesn't yield and that's when it's tough. Politically, that's hard, right? Because we're a government run".(P12)

Participants emphasize the necessity of having a dedicated innovation team, expert leadership within medical centers, and allocated time for clinicians to concentrate on innovation, which is currently distinct from their time dedicated to patient care, teaching, and research.

"I think the number of people on a team is very important, … and dedicated team members." (P4)

"Resources are fundamental … resources to elevate and enable, this is important – and that is funding, expertise, time, etc." (P10)

The participants mentioned some barriers that relate to resources for innovation, like the need to share resources with other units in the hospital, limited time, and limited budget to attract experts, who can

often earn more in the commercial sector.

"Dedicated innovation, IT resources, … legal resources, we share resources and that makes it challenging." (P4)

"We need to afford these people and have the environment for these people to flourish in. So, it is very hard to compete with the commercial sector in this space because they get paid more." (P10)

2.8 External partnerships

External partnerships were identified as a key driver for fostering an innovative culture at medical centers by introducing new perspectives and fresh insights.

"We need to innovate not alone but with partners, in particular from the private sector. We need entrepreneurs, we need private companies within industry to innovate." (P5)

"Multidisciplinary can bring ideas from other places into medicine." (P16)

One participant shared that some clinicians might be reluctant to collaborate with the industry because they believe the industry's primary goal is financial gain.

"Some doctors don't want to deal with the industry." (P5)

"A public service …so that's not compliant with the industry interests." (P5)

2.9 Rewards

Participants noted that monetary rewards can boost staff motivation to drive innovation at medical centers, by increasing engagement. They mentioned the need to communicate these rewards to the organization.

"You have to align incentives with that [innovation], so people are really incentivized to be innovative."(P4)

"... you take innovators, and you reward them, and you communicate around what they are doing, how they help the institute and their service, and particularly the patient." (P5)

"In some way recognizing the value of it [innovation], … reward is one way to do it." (P9)

"Incentives make things real, moving from ideas to action." (P11)

One participant said clinicians do not like to get rewards for innovation, because they are not sure it is ethical to deal with innovation instead of caring for patients or conducting research.

"...They [clinicians] don't like to be ranked [for innovation]… maybe because of the contradiction… because they are not sure if it's ethical." (P5)

2.10 Regulations

Internal regulations, as sets of internal rules and procedures, and external regulations, as state regulations were mentioned by a few participants as both barriers, inhibiting the innovative culture and as category that can support the innovative culture. One participant mentioned it is the most important category that influences innovative culture:

"I think that the regulations are probably the number one issue [influencing the innovative culture] ... there's so many regulations that you have to comply with and then gravity, the consequences. … the effects [of regulations] on the patient are serious, even with changing software." (P2)

“Regulation influences the innovation as part of the system and should support it." (P11)

Quantitative results

Demographics

A total of 202 clinicians, managers and innovation managers from 25 international medical centers filled in the questionnaire. Of these, only 126 (62.4%) were included in further statistical analysis, with the other 76 (37.6%) respondents excluded from the analysis due to missing scale data. The general and demographic characteristics of the sample are shown in Table II.

Table II. Participants' demographic and general characteristics

Parameters	N (%)
Age*	N = 126
< 29	5 (4%)
30–39	14 (11.1%)
40–49	46 (36.5%)
50–59	37 (29.4%)
> 60	20 (15.9%)
Gender	
Male	62 (49.2%)
Female	57 (45.2%)
Non-binary	4 (3.2%)
Prefer not to answer	3 (2.3%)
Countries	
Israel	78 (61.9%)
USA	33 (26.2%)
Australia	9 (7.1%)
Canada	4 (3.1%)
Europe	2 (1.5%)
Innovation Leader	
Yes	98 (77.8%)
No	22 (17.5%)
Don’t know	6 (4.8%)
Type of medical center	
Public	91 (72.2%)
Private nonprofit	31 (24.6%)
Private for profit	4 (3.2%)
Number of Beds	
< 299	6 (4.8%)
*Total N does not add to 126 due to missing data	

Parameters	N (%)
300–499	13 (10.3%)
500–999	21 (16.7%)
> 1000	84 (66.7%)
Academic Medical Center (AMC)	
Yes	111 (88.1%)
No	15 (11.9%)
Position	
Physician	52 (41.3%)
Intern	5 (4%)
Registered nurse	8 (6.3%)
Dietitian	2 (1.6%)
Pharmacist	2 (1.6%)
Physical Therapist	22 (17.5%)
Senior leader	23 (18.3%)
Other	12 (9.6%)
Unit	
Many	19 (15.1%)
Combined medical and surgical	6 (4.8%)
Medical	23 (18.3%)
Surgical	10 (7.9%)
Oncology/Hematology	5 (3.9%)
Pediatrics	4 (3.2%)
Rehabilitation	4 (3.2%)
Anesthesiology	3 (2.4%)
Management	17 (13.5%)
Innovation	13 (10.3%)
*Total N does not add to 126 due to missing data	

Parameters	N (%)
Various units (Cardiology, ER, gastro, ICU, labor and OBGYN, pathology, pharmacy, radiology, information)	12 (9.5%)
Other	10 (7.9%)
Seniority*	
< 2 Years	11 (8.7%)
2–3	12 (9.5%)
4–5	14 (11.1%)
6–10	30 (23.8%)
> 10	43 (34.1%)
*Total N does not add to 126 due to missing data	

Exploratory Factor Analysis

The sample adequacy for EFA was determined using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy for which a cutoff above 0.50 is required. The KMO value for the 30-item pool model was high (KMO = 0.95) indicating good internal consistency, sufficient for EFA. 20 of the 30 items were retained following EFA. Based on eigenvalues, the Scree test shows a discernible flattening of the plot after the third factor, suggesting a three-factor structure. Each factor is measured by 3 + items as recommended for scale construction [58]. These three factors account for 66.01% of the observed variance. Key EFA components are presented in Table III (Eigenvalues) and in Figure II (Scree Plot).

Table III. EFA Results on twenty statements representing categories that influence the innovation culture. An additional category on whether the medical center had an innovation leader, was assessed using a closed-ended question (Yes/ No/ Don’t know) (n = 126)

#	Statements	Factor loading		
		1	2	3
1.	There is trust and open communication among colleagues	.691		
2.	Teams involved in innovation projects at the medical center include people with diverse backgrounds	.683		
3.	The medical center prioritizes learning and growth, and encourages people to gain knowledge that may challenge the status quo	.683		
4.	Data is used to support decision making	.674		
5.	Employees are encouraged to challenge the status quo	.645		
6.	When people try new things and fail, they are still being encouraged to do so	.643		
7.	Innovative ideas and processes are effectively communicated across the organization	.642		
8.	My direct manager encourages me to bring new ideas	.641		
9.	My unit/department collaborates with others to drive innovation	.604		
10.	Innovative ideas are being implemented	.652		
11.	The medical center has a dedicated innovation team		.787	
12.	The medical center teams up with external startups		.690	
13.	Our organization has experts in innovation and entrepreneurship who support innovation		.663	
14.	There are innovation champions (people who drive activities forwards) in the medical center		.645	
15.	There are collaborative efforts with external partners for innovation projects		.618	
16.	Employees can get funding to promote innovative projects		.606	
17.	I know whom to reach out to when I have an innovative idea		.552	
18.	There are incentives or rewards for innovation that encourage employees to engage in innovation activities			.712
19.	There are financial incentives for innovation and entrepreneurship			.696
20.	Employees can get dedicated time to invest in innovation			.587

*1-Organic innovation and entrepreneurship, 2- Resources and open innovation, 3- Incentives and rewards

#	Statements	Factor loading		
		1	2	3
	Eigenvalues	12.02	1.19	1.01
	% of variance	27.86	22.42	15.74
	Cronbach's alpha	0.943	0.929	0.842
	Factors mean (SD)	2.23 (0.9)	2.04 (0.95)	2.82 (1.12)
	Range	1–5	1–5	1–5
*1-Organic innovation and entrepreneurship, 2- Resources and open innovation, 3- Incentives and rewards				

Figure II. Scree test plot for exploratory factor analysis (EFA) of the innovation culture scale

Innovation culture survey in medical center

Based on the EFA, we can differentiate between three factors that we label as: 1. Organic (internal) innovation and entrepreneurship (10 items); 2. Resources and Open (external) innovation (7 items); and 3. Incentives and Rewards (3 items). The internal consistency was $\alpha = .964$ for the total scale, $\alpha = 0.943$ for Factor 1, $\alpha = 0.929$ for Factor 2, and $\alpha = 0.842$ for Factor 3. Mild to moderate correlations were found between the three factors. Correlation coefficient values ranged between $r = 0.811$ (Organic innovation and Entrepreneurship, and Resources and Open innovation) and $r = 0.727$ (Resources and Open innovation, and Incentives and Rewards; $p < 0.001$ for all).

After analyzing the factors, we saw that the first factor, organic innovation and entrepreneurship, was composed of six categories, including leadership, methods and processes, risk taking, goals, relationships and knowledge. The second factor, resources and Open innovation, was composed of two categories and the third factor Rewards and Incentives is composed of one category and one item: time. Figure III demonstrates the new structure that was derived from combining the qualitative and quantitative stages.

Figure III. The structure of the factors, categories and items (sub-categories) that shape the innovation culture in medical centers.

Source: Authors own work.

DISCUSSION

Our study aimed to identify the factors affecting the innovative culture in international medical centers from the perspective of innovation leaders, create a questionnaire to measure this culture, and validate it. For this goal we utilized a mixed-method approach, integrating both qualitative and quantitative analyses. We identified three key factors, nine categories, and twenty-one items that foster an innovative culture within medical centers. We defined the factors we found as organic innovation and entrepreneurship, resources and open innovation, and incentives and rewards. Organic innovation and entrepreneurship encompass six categories: leadership, innovation methods and processes, risk-taking, relationships, goals, and knowledge. The resources category was grouped with open innovation, which relates to external partnerships, while incentives and rewards encompassed recognition and dedicated time allocated for innovation.

The literature search on the culture of innovation in organizations and medical centers has revealed various methods used to define and measure innovation culture [24]. The Dobni model, which is the most referenced innovative culture construct [42, 45], discusses four dimensions: innovation intention, infrastructure, influence, and implementation [43]. The first factor we defined as organic innovation and entrepreneurship might resemble innovation intention. Categories such as methods and resources might correspond to the second dimension, infrastructure. The dimension of open innovation might align with innovation influence, consisting of market and value orientation. The third factor of incentives and reward was mentioned in other studies as a dimension [16, 59, 60].

Given the increasing interest in innovation and transformation within medical centers [3] and the establishment of innovation centers in these institutions [36], opinions were gathered from innovation leaders working in these centers. The process of generating scale categories and items through interviews, rather than literature review, provided practical insights based on participants' experiences and aimed to minimize researchers' bias.

Analysis of the interview data identified seven categories previously recognized in the literature as dimensions of innovation culture: tools, risk-taking, resources, knowledge, goals, relationships, and rewards [16, 59, 60]. Our study introduced three additional categories: leadership, external partnerships, and regulations. Most participants recognized leadership as the most critical and influential factor in promoting an innovative culture. The leadership actions encourage employees' innovative behavior both directly and indirectly by creating a setting where innovation is anticipated, supported, and facilitated. Organizational leadership determines the intention to innovate and sets strategic goals for innovation [21, 43, 61]. Leadership behavior and innovation culture have been found to be significantly correlated [60]. Leaders shape the organizational culture by offering direction, priorities, and values [25]. One of the primary reasons some healthcare organizations overlook innovation is the lack of leadership support for innovation [62].

’Open innovation‘ describes how organizations open their innovation processes for external influence and collaboration [63]. Examples are linked to pooling collaborative research and development (R&D) activities and/or engaging in trading of intellectual property rights to spin in or spin out strategic

innovation resources. The participants in our study noted that partnerships with external entities can facilitate innovation. They stressed the advantages of external learning, funding from private industry and government grants, and risk sharing. Leading innovative companies in the market often collaborate with external partners, including competitors [19]. Implementing this approach in medical centers could encourage mutual learning and co-creation. A study on sustainable innovation centers in medical facilities identifies two key structural elements for success: balancing internal and external focus and providing essential support and skills lacking in the broader institution [64]. These findings are consistent with ours, indicating the importance of investing in both organic and open innovation while ensuring necessary resources are available.

Previous research has emphasized the role of resource distribution in fostering innovation, both in its practical sense, enabling new possibilities and its symbolic significance, demonstrating organizational priorities [1, 62, 65]. The resources in our study included having an innovative team and experts in innovation and entrepreneurship. The degree to which an organization allocates resources for its innovation efforts, especially through the identification of innovation champions and experts, influences its level of innovation [42]. In our study, resources and external partnerships categories were loaded onto one factor, suggesting that external partnerships could be a valuable resource for driving innovation, when those partnerships introduce new ideas, perspectives, funding, and share the risk of pursuing new initiatives. Nevertheless, we anticipated these two categories to load as separate factors, and we aim to test this in further research with a larger sample size.

From a health policy perspective, governments can actively encourage open innovation by offering joint academia-industry grants, streamlining regulatory processes, and fostering ecosystems in which public and private stakeholders collaborate across borders [5]. The European Innovative Health Initiative (IHI), for example, brings together industry, government, academia, and health providers and provides access to data as a catalyst for big-data-driven health research and innovation [66, 67]. In terms of financial investment, the Israel Innovation Authority uses public–private partnerships to co-invest with private companies, mitigating financial risk and supporting high-tech development in the health sector [68]. In the health domain specifically, the Authority launched a Digital Health Pilot Program together with the Ministry of Health and the Digital Israel Initiative, which co-funds the R&D and piloting of digital health technologies in Israeli healthcare organizations in order to offset R&D risk, make it easier for healthcare organizations to work with industry, and help companies commercialize their products [68]. More recently, the Authority reported investing approximately NIS 500 million in health-tech over a single year, including a pilot program that facilitated collaborations between startups and hospitals [69]. Medical centers that score low on the resources and open innovation factor of our scale may particularly benefit from such policy instruments.

The first factor, organic innovation and entrepreneurship, also carries policy implications. Empowering front-line clinicians and administrators to identify problems and design solutions ensures that innovations remain grounded in real-world challenges, and when clinicians are involved in developing solutions, adoption is more likely because the technologies directly address their daily needs [5]. To

foster this, health systems should embed entrepreneurship into medical and nursing education and provide structured training programs for staff [5], consistent with the knowledge category identified in our study. Patients must also be central to this process; involving patient and family advisory councils in design sprints and evaluations ensures that innovations reflect patient priorities, increasing both usability and value [70, 71].

We added a new item under innovative methods (tools) focused on 'using data to support decisions.' This item was not mentioned in other studies discussing innovative culture in medical centers and is particularly relevant today due to the advancement of Artificial Intelligence (AI) in healthcare. AI has the potential to transform clinical decision-making and improve operational efficiency. Generative Artificial Intelligence (Gen AI), an essential branch within AI, uses machine learning to create accurate data and generate new content from existing datasets [72]. To utilize AI for medical applications, medical centers should prioritize organizing data and ensuring access to data for medical use. Realizing this potential on a scale also requires policy action: policies governing AI, data sharing, and digital privacy must be designed to safeguard patients while enabling responsible innovation, and nationally coordinated policies are needed to ensure seamless interoperability of health data [5, 73].

Regulations were mentioned by the innovation leaders as both hindering innovations, when they are too restrictive and fostering innovation culture, if they help to navigate and facilitate the processes, from ideation to implementation. Our qualitative findings supported the developed theory linking regulation and innovation, focusing on two criteria: innovation type (improving or challenging technologies) and regulatory uncertainty (high or low). The relationship can be negative or positive based on these factors [74]. Eventually, the regulatory category was removed based on the results of a quantitative analysis using exploratory factor analysis, which indicated it might be less significant in influencing the culture of innovation in medical centers. Medical centers can develop creative solutions to address regulatory implications and adjust internal regulations to meet their goals. Nevertheless, the lower weight of regulation in staff perceptions does not diminish its importance at the system level, where regulatory frameworks must evolve to facilitate, rather than hinder large-scale transformation [5]. Procurement is a related policy level. Current procurement systems often contribute to slow adoption of innovation [75], and more agile approaches are required, enabling rapid pilot, evaluation, and contracting. A tiered model can balance flexibility with scalability: local institutions conduct quick proof-of-concept pilots, while central authorities scale up solutions that demonstrate value, supported by predetermined funding [5]. An example of such a program is the Horizon 2020-funded Platform for Innovation of Procurement and Procurement of Innovation (PiPPi) project [76].

In analyzing the various categories that influence an innovative culture within medical centers, we could distinguish between categories that support the infrastructure for innovation and those representing innovative attributes and behaviors. Innovation infrastructure includes categories like methods (tools), processes, and resources designed for innovation, compared to categories related to innovative behaviors such as leadership support to encourage creativity and innovation, clear goals to promote innovation, internal relationships fostering collaboration, openness to external partnerships, risk-taking

approaches, rewards and recognition to motivate and foster an innovative culture. More recent studies have discussed tangible factors influencing innovation culture, such as resources, processes, and measurement of success, alongside intangible factors like values, behaviors, and climate [42, 77].

Health Policy Implications

Healthcare leaders and policymakers could use the survey to inform decision-making, support organizational and system-level innovation strategies, guide resource allocation, benchmark institutions, and contribute to improvements in quality, efficiency, equity, and workforce well-being. The survey can therefore serve as a readiness diagnostic before major investments. For example, before launching a national digital health or AI program, ministries of health and health insurers could administer the survey to select sites that are ready to host pilots, to tailor implementation support in sites that are not, and to set realistic timelines for scale-up. At the organizational level, boards and executive teams could incorporate factor scores into strategic plans and use them to define measurable innovation goals, consistent with the participants' emphasis on clear goals and key performance indicators.

Our survey can help to benchmark institutions according to their culture of innovation. The patient safety culture field provides a relevant precedent. The AHRQ Hospital Survey on Patient Safety Culture was validated at the individual, unit, and hospital levels [78] and now supports comparative databases that hospitals use to benchmark their results [39]. A similar approach to innovation culture could enable national or international benchmarking, identify high-performing centers whose practices can be shared, and help regulators and funders target support to centers that lag. Such benchmarking should also account for system-level conditions, since innovation capacity in healthcare depends not only on individual organizations but also on the wider health system in which they operate [79].

More broadly, our findings suggest that innovation capacity should be treated as a component of health-system performance and resilience, alongside quality and safety. Learning health systems, in which data and experience are continuously translated into knowledge and improved practice [80], depend on the cultural conditions captured by the scale: data-driven decision-making, continuous learning, psychological safety, and collaboration across professional and organizational boundaries. Policymakers could therefore consider including innovation-culture indicators in national hospital performance frameworks, in accreditation standards, or as conditions for innovation funding, in the same way that patient safety culture measurement has become embedded in quality improvement programs [39].

Finally, the survey can connect organizational culture with national innovation strategy. Digital health, clinician-led innovation, commercialization, and procurement reform are interconnected drivers of sustainable transformation [5]. The key question is how medical centers can embed innovation in their core mission through national strategies that align healthcare transformation with economic development [5]. The innovation culture scale provides an organizational metric for tracking whether

investments in funding, infrastructure, partnerships and incentives are creating conditions that support innovation in medical centers.

Limitations

This study, while providing valuable insights, has several limitations. Our research relied on Exploratory Factor Analysis and did not proceed to Confirmatory Factor Analysis, which would require a larger sample size for validation. Consequently, future studies must address this gap. In addition, although we aimed to provide an international perspective by including multiple countries in the analysis, the cultural differences between nations may not be adequately represented in the results. Future research should consider sampling medical centers specific to individual countries to better capture these nuances. Additionally, the 16 medical centers involved in the qualitative phase may not reflect the diversity of medical centers in general. Expanding the sample to include a broader spectrum of institutions will help improve the representativeness of the findings.

Conclusion: We aimed to develop a scale to measure innovative culture in medical centers after identifying the key factors influencing the innovative culture. The statistical analysis of the complete questionnaires demonstrated high internal consistency and reliability, with Cronbach's alpha of 0.964. Future studies should aim to validate the questionnaire with a larger sample and compare different medical center types across various countries to further measure and demonstrate its broad applicability. Following further validation, the survey may provide policymakers and health-system leaders with a practical evidence base for developing, implementing, and evaluating innovation strategies. Total and factor-level scores could be used to identify organizational and system-level barriers, guide the allocation of funding, workforce capacity, protected time, training, and implementation infrastructure, and enable context-sensitive benchmarking across institutions, departments, and professional groups.

Declarations

Author Contribution

O.B. led the study, conducted the literature review, interviewed innovation leaders, coded the data and developed themes, designed and validated the questionnaire, analyzed the results, and drafted the manuscript.A.D. supported the qualitative analysis, led the study planning, directed data collection, and contributed to coding the data and developing themes.E.Z. proposed the initial concept of evaluating innovation culture in medical centers, reviewed the study process, and provided critical input.R.M. contributed to the study methodology, mentored O.B., and supervised data processing.

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Data Availability

All data supporting the findings of this study are available within the article and its Supplementary Information. Additional information may be obtained from the corresponding author upon reasonable request at orli.biger@gmail.com.

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80. Friedman CP, Wong AK, Blumenthal D. Achieving a nationwide learning health system. Sci Transl Med. 2010;2(57):57cm29. 10.1126/scitranslmed.3001456. SUPPLEMENT 1 Innovation Culture Interview Guide for Qualitative Research General information (fill out before the interview): ● Academic / Nonacademic medical center ● Public/ Private medical center / Private non-profit ● # beds in the medical center (small medical center: <249, medium medical center: 250–449 beds, large medical centers: >450 beds) ● Central vs. Peripheral medical center Open Questions for the qualitative interview: Part 1
81. What. is your role? Do you practice innovation / research?.
82. Were. you trained in innovation and / or entrepreneurship? Where?.
83. Who do you report to?.
84. Please define Innovation. and Innovation Culture in Medical Centers.
85. Please describe your medical center vision. and goals in promoting innovation. (e.g. Improve care, Improve QoL, improve safety, improve profitability, improve prestige, other).
86. Please describe the. challenges to drive innovation at your medical center.(e.g. regulation, barriers).
87. What are the. main categories that influence innovative culture in your medical centers? Why? Please give some examples.
88. Please. rate each category from 1–10, how important they are for innovation and explain why. (10- Most important, 1- not important at all).
89. Please rate the. categories from the most important to the least. Why? Please share your experience.
90. Part. 2.
91. A work from. the UK found 7 dimensions that influence the innovative culture, including risk taking, resources, knowledge, goals, rewards, tools and relationships. Please let me know what you think about them and rate them from 1–10. (10- Most important, 1- not important at all).
92. Will you add or remove some of them?.

Figures

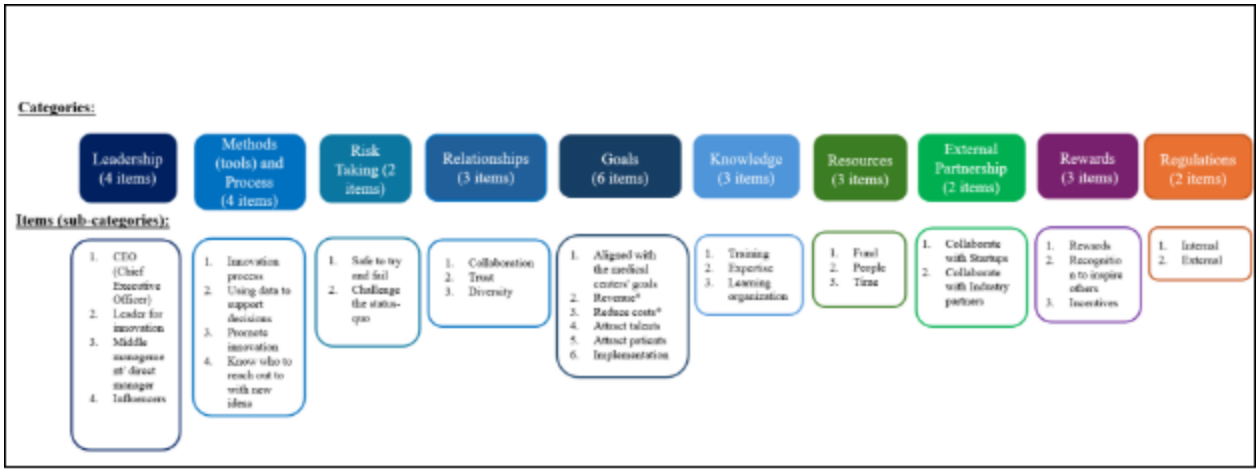


Figure 1

Categories and Items (sub-categories) shaping the innovation culture in medical centers

Source: Authors own work.

* The items “Revenue” and “Reduce costs” under goals were removed after discussions with the authors and seven innovation leaders.

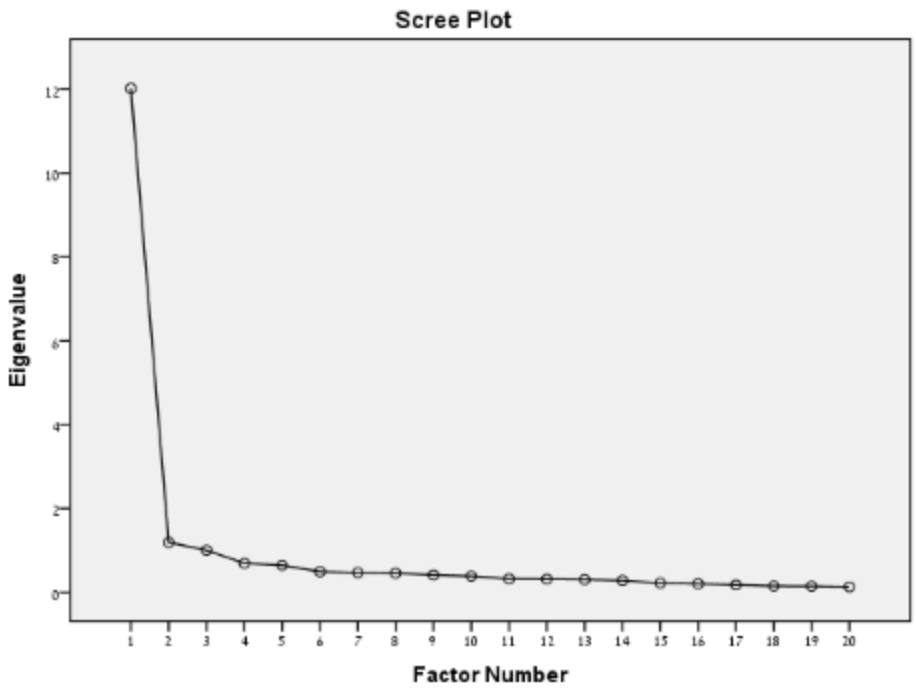


Figure 2

Scree test plot for exploratory factor analysis (EFA) of the innovation culture scale

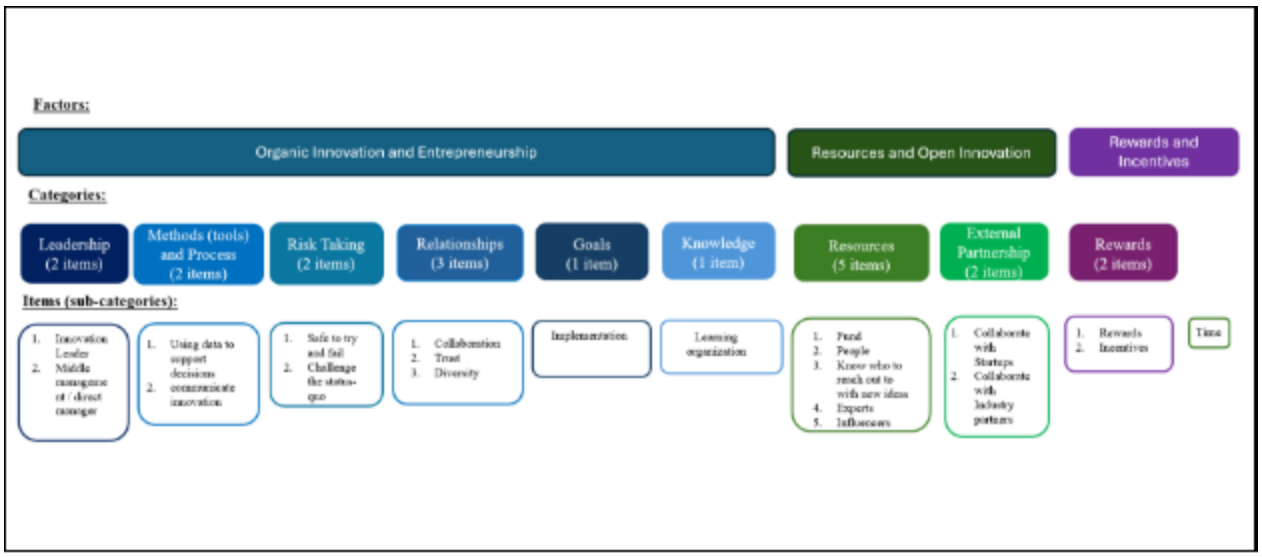


Figure 3

The structure of the factors, categories and items (sub-categories) that shape the innovation culture in medical centers.