Taking a step forward in continuous improvement: a review on sustainability and Collaborative Networks

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ABSTRACT

Introduction: In order to overcome barriers to quality improvement and sustain continuous improvement, services must plan and apply specific strategies. Especially in Brazil, both private and public systems face an urgent need to maintain successful improvements in the current scenario of increasingly restrained budgets through innovative approaches. Therefore, the purpose of this paper is to present a narrative review of strategies to sustain continuous improvement. Methods: This article describes a narrative review of literature on the following databases: Emerald, Scopus (Elsevier), OneFile (GALE), Technology Research Database, Web of Science and Engineering Research Database, using the terms: 'sustainability' and 'continuous improvement'. Findings: This study selected 18 articles from 2003 onwards, showing a yearly growth in number of publications, which points an increasing presence of continuous improvement initiatives worldwide. Discussion: This literature review shows a growing concern to provide a reliable framework for evidence-based improvements, combined with innovation and a system wide approach. This literature review should assist other scholars and practitioners who are interested in substantiating their improvement efforts.

Categories and Subject Descriptors

J.3 [**Life and Medical Sciences**]: Health

General Terms

Management, Human Factors and Standardization.

Keywords

Continuous Improvement, Collaborative networks, Service Quality.

1. INTRODUCTION

Healthcare improvement initiatives have been widely applied to sustain higher quality standards and reliability in health systems around the world [1-3]. In this sense, the Lean Ecosystem applied to Healthcare has provided major contributions by establishing a clear pathway towards a patient-centered culture, eliminating waste and promoting continuous improvement. Before its application in healthcare, these concepts and tools were designed to Manufacturing. In this sector, Lean principles and tools have been developed since its first approach – a period called Discovery phase (Stone, 2012) from 1970 to 1990, followed by its Dissemination phase (1991-1996), Implementation phase (1997-2000), Enterprise phase (2001-2005), and the most recent phase of Performance (2006-2009) [4]. All these phases contributed to consistently apply and disseminate Lean implementation and improvement initiatives.

In this later phase, Shetty (2011) and Sarantopoulos (2015) highlight the need to thoroughly assess lean implementation status, developing new tools to effectively capture an inside perspective, allowing comparison within and between companies [5,6]. One can easily find a correspondence between those phases of Lean Manufacturing and the implementation of Lean in Healthcare. A recent literature review presented by our group [7] has shown that most lean implementation initiatives are restrained to a department level, due to five main barriers:

- Culture and resistance to change;

- Lack of awareness;

- Poor training/coaching;

- Availability of resources and time;

- Lack of leadership.

In order to overcome these barriers and sustain continuous improvement, services must plan and apply specific strategies. Especially in Brazil, both private and public systems face an urgent need to maintain successful improvements in the current scenario of increasingly restrained budgets through innovative approaches [1]. Therefore, the purpose of this paper is to present a narrative review of strategies to sustain continuous improvement.

2. METHODS

This article describes a narrative review of literature performed in July 2015 on the following databases: (a) Emerald (www.emerald.com), (b) Scopus (Elsevier) (c) OneFile (GALE), (d) Technology Research Database, (e) Science Citation Index Expanded (Web of Science) and (f) Engineering Research Database. The Emerald database (a) provides a Management collection with over 80,000 articles from over 200 titles. This database was chosen considering its relevance in fields such as Education, Engineering, Library Studies and Marketing; with titles featured in Thomson Reuters (ISI), Scopus and other relevant ranking systems. Databases from (b) to (f) were accessed through the Brazilian Scholars Portal hosted by the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES), which provides access to over 37 thousand full-papers in 126 databases, books, norms, statistics and audiovisual content.

Besides searching for specific terms in these databases, techniques called hand searching and snowballing also allowed to manually examine entire contents of a journal issue to identify all eligible reports and to check the reference lists of journal articles [8].

3. FINDINGS

3.1 Quantitative data

Initial terms used to search were 'sustainability' and 'continuous improvement', providing the corresponding number of articles for each database: (a) 10951 and (b-f) 841. At this point, an inclusion criteria was applied, selecting those papers that presented in the title or in their content a reference to improvement implementation in healthcare services, such as 'improvement initiative', 'lean thinking', 'Healthcare'. Studies published before 2003 were excluded. Also, a specific search was performed for articles related to Collaborative Networks along with the initial search terms ('sustainability' and 'continuous improvement'). This last search provided (a) 1222 and (b-f) 3 articles, which were also selected according to previously described inclusion criteria. Therefore, this study selected: (a) 12 and (b-f) 6 studies from each source. As noticed in a previous review paper (Spagnol, 2013), a yearly growth in number of publications points to an increasing presence of lean healthcare worldwide. Selected studies differed in their research questions, design and results; to compare results they were organized under the following topics: i) 'Human Resource Performance and Training' (5 articles); ii) 'Quality Improvement Programs' (6 articles); iii) 'Sustainability' (4 articles) and iv) 'Collaborative Networks' (4 articles) in Table 1.

Table 1. Selected articles after search for 'sustainability' and 'continuous improvement'

i) Human Resource Performance and Training	
Articles	**Purpose/Findings**
Title: A case study into operational team working within a UK hospital. **Published in:** International Journal of Operations & Production Management, 2008, Vol. 28 Iss: 3, pp.215 – 237. **Authors:** David Bamford, Michael Griffin. **Location:** Manchester Business School, Manchester, UK and King's College Hospital NHS Foundation Trust, London, UK.	**Purpose:** This paper aims to report on research into human resource management within an operations management environment; specifically, operational teamwork amongst health care workers in a hospital. **Findings:** The results show the construct of the team had little operational definition. Key factors identified as contributing to effective teamworking include: leadership; frequency of team meetings; a climate of trust and openness. There was limited evidence of truly multi-disciplinary teams and of organizational support for teamworking.
Title: Improving motivation among health care workers in private health care organizations: A perspective of nursing personnel. **Published in:** Baltic Journal of Management, 2007, Vol. 2 Iss: 2, pp.213 – 224. **Authors:** Zydziunaite Vilma, Katiliute Egle. **Location:** Vytautas Magnus University, Kaunas, Lithuania, Kaunas University of Technology, Kaunas, Lithuania.	**Purpose:** The study aims to explore the experiences of nursing personnel in private health care organizations in Lithuania, in terms of their work motivation and satisfaction, promotion and quitting the job, interpersonal interaction at work and to identify areas for sustainable improvement to the health care services they provide. **Findings:** Results showed no statistical differences among nurse practitioners and executives of what motivates them in private health care organization as workplace and illuminated factors that decrease and increase motivation among nurses.
Title: Developing junior doctors as leaders of service improvement. **Published in:** Leadership in Health Services, 2014, Vol. 27 Iss: 4, pp.316 – 329. **Authors:** Jason Micallef, Brodene Straw. **Location:** Institute for Health Leadership, Department of Health, Perth, Australia.	**Purpose:** This paper aims to provide an overview of the design and initial outcomes of a leadership and service improvement program for junior medical staff. **Findings:** The Medical Service Improvement Program illustrates a successful approach to developing junior doctors to lead improvements in health service delivery. The program

	has resulted in tangible personal outcomes for participants, in addition to important organizational outcomes.
Title: Leadership for health improvement – implementation and evaluation. **Published in:** Journal of Health Organization and Management, 2009, Vol. 23 Iss: 2, pp.200 – 215. **Authors:** Susan M. Carr, Monique Lhussier, Joanna Reynolds, David J. Hunter, Catherine Hannaway. **Location:** Northumbria University, Newcastle upon Tyne, UK, Durham University, Durham, UK, Association of Public Health Observatories in the UK and Ireland, Alcuin Research & Resource Centre, University of York, York, UK.	**Purpose:** The purpose of this paper is to present a co-authored reflection on the health improvement leader development programme and the key evaluation messages derived from piloting in an English National Health Service region. It highlights the specific attributes of this approach to health improvement leadership development and clarifies health improvement development issues. **Findings:** The evaluation exposes the health improvement leaders needs of a multi-organisation cohort, offers some explanations for successful achievement of learning needs while also exposing the challenges and paradoxes faced in this endeavour.
Title: On Your Time: Online Training for the Public Health Workforce. **Published in:** Health Promotion Practice, March 2014, Vol. 15, Suppl 1 48S–55S. **Authors:** Hope Worden Kenefick, Sharon Ravid, Kathleen MacVarish, Jennifer Tsoi, Kenny Weill, Elizabeth Faye, Anne Fidler. **Location:** HWK Consulting, Barrington, NH, USA, Boston University School of Public Health, Boston, MA, USA, K. Weill Consulting Group, LLC, Brookline, MA, USA.	**Purpose:** Authors describe the On Your Time training series, an effective distance education program and training model for public health practitioners, which includes a standardized process for development, review, evaluation, and continuous quality improvement. The replicable model incorporates what is known about best practices for online training and maximizes available resources in the interests of sustainability.

ii) Quality Improvement Programs

Title: Introduction of a quality improvement program in a children's hospital in Tehran: design, implementation, evaluation and lessons learned. **Published in:**	**Purpose:** Reports addressing continuous quality improvement (CQI) methods in developing countries are scant and there are questions about the applicability of quality improvement methods in such settings. In this article, authors present the structure and output of a formal quality improvement program implemented in a teaching hospital affiliated with the Tehran

International Journal for Quality in Health Care; 2007, Volume 19, Number 4: pp. 237–243. **Authors:** S. Mehrdad Mohammadi, S. Farzad Mohammadi, Jerris R. Hedges, Morteza Zohrabi And Omid Ameli. **Location:** Tehran University of Medical Sciences and Health Services, Center for Academic and Health Policy, Tehran University of Medical Sciences and Health Services, Eye Research Center, Oregon Health and Science University, School of Medicine, Department of Emergency Medicine, and Management Sciences for Health.	University of Medical Sciences is presented. **Findings:** Thirty improvement projects were initiated. Twenty-five of the projects were completed. In an evaluation survey more than 70% of respondents assessed a 'positive impact' on organizational culture, work efficiency and quality of services. More than 90% believed that the changes were sustained, and more than 60% reported that they have implemented additional improvement projects.
Title: Implementation of Quality Improvement Skills by Primary Care Teams: Case Study of a Large Academic Practice **Published in:** Journal of Primary Care & Community Health 2014, Vol. 5(2) 101–106. **Authors:** Brook Watts, Renée H. Lawrence, Simran Singh, Carol Wagner, Sarah Augustine, and Mamta K. Singh. **Location:** Louis Stokes Cleveland Department of Veterans Affairs Medical Center, Cleveland, OH, USA, Case Western Reserve University School of Medicine, Cleveland, OH, USA.	**Purpose:** To (a) identify opportunities and challenges to QI efforts in a large primary care practice in order to (b) develop action plans to facilitate QI work into primary care teams. **Findings:** In the 18 months since local leadership prioritized conducting team-based QI projects, team members described multiple exposures to QI training, coaching resources, and data/analysis support. No team developed a formal aim statement. Six of the 11 teams completed one of the steps beyond the initial team discussion. Four teams attempted to apply an intervention. Challenges included team time and competing demands/priorities; 3 of the 4 teams attempting to implement a project credited a data/informatics facilitator for their progress.
Title: Making It Better: Building Evaluation Capacity	**Purpose/ Conclusion:** This paper describes a province-wide initiative aimed at building the capacity of

In Community Mental Health. **Published in**: Psychiatr Rehabil J. 2005 Winter; 28(3):234-41. **Authors:** Bonnie Kirsh, Terry Krupa, Salinda Horgan, David Kelly, Sue Carr. **Location:** University of Toronto, Toronto, Ontario, Queen's University, Kingston, Ontario, and Ontario Federation Of Community Mental Health And Addictions Programs, Toronto, Ontario.	community mental health programs to participate in program evaluation and development by transferring knowledge, promoting discussion and developing resources. Active involvement of stakeholders and evaluation of the current capacity of the field informed the ongoing development of the initiative. Recovery served as a guiding framework for formulating and understanding community mental health outcomes. Despite the interest of the field in evaluation activities, programs were constrained by limited resources and accountability structures. Sustainability of the project would be enhanced by direct work with programs to facilitate application of Continuous improvement.
Title: Quality-improvement analytics for intravenous infusion pumps **Published in:** Am J Health-Syst Pharm—Vol 70 Apr 15, 2013. **Authors:** Susan J. Skledar, Cynthia S. Niccolai, Dennis Schilling, Susan Costello, Nicolette Mininni, Kelly Ervin and Alana Urban. **Location:** University of Pittsburgh Medical Center and University of Pittsburgh, Pittsburgh, PA, USA.	**Purpose:** The implementation of a smart-pump continuous quality-improvement (CQI) program across a large health system is described, with an emphasis on key metrics for outcomes analyses and program refinement. **Conclusion:** A smart-pump CQI program is an effective tool for enhancing the safety of i.v. medication administration. The ongoing refinement of the drug library through the evelopment and implementation of key interventions promotes the growth and sustainability of the smart-pump initiative systemwide.
Title: Improving the Implementation of Evidence-Based Practice and Information Systems in Healthcare **Published in:** International Journal of Healthcare Information Systems and Informatics, 2011, 6(2), 37-59. **Authors:** Arling, P. a., Doebbeling, B. N., & Fox, R. L. **Location:** Butler University, USA, Indiana University School of Medicine, USA and Texas State	**Purpose:** In healthcare, evidence-based practice (BP) integrates clinical expertise with the best available external evidence from systematic research. Yet even with the aid of technology, implementation of EBP in many settings remains a challenge due in part to the complexity of the healthcare system and the lack of a strong theoretical and analytical foundation to guide implementation efforts. This paper combines research from the fields of healthcare implementation science and social networks to present a theoretically based, integrated framework for the study of EBP implementation. This study explores the application of the framework to a complex healthcare collaborative, the MRSA infection

University - San Marcos, USA.	control project, a project intended to foster the implementation of EBP to reduce the spread of MRSA infections.
Title: A comprehensive approach to quality management of intensive care services **Published in:** International Journal of Health Care Quality Assurance, 2010, Vol. 23 Iss: 3, pp.287 – 300. **Authors:** Seetharaman Hariharan, Prasanta Kumar Dey. **Location:** The University of the West Indies, St Augustine, Trinidad and Aston Business School, Aston University, Birmingham, UK.	**Purpose:** The purpose of this paper is to develop a comprehensive framework for improving intensive care unit performance. **Findings:** Stakeholders identified various intensive care unit issues. Managerial performance, organizational processes and insufficient staff were considered major issues. A logical framework was developed to plan an improvement project to resolve issues raised by clinicians and patients. Improved infrastructure, state-of-the-art equipment, well maintained facilities, IT-based communication, motivated doctors, nurses and support staff, improved patient care and improved drug availability were considered the main project outputs for improving performance. The proposed framework is currently being used as a continuous quality improvement tool, providing a planning, implementing, monitoring and evaluating framework for the quality improvement measures on a sustainable basis.

iii) Sustainability

Title: "If We Build It, Will It Stay?" A Case Study of the Sustainability of Whole-System Change in London. **Published in:** The Milbank Quarterly, Vol. 90, No. 3, 2012 (pp. 516–547). **Authors:** Trisha Greenhalgh, Fraser Macfarlane, Catherine Barton-Sweeney and Fran Woodard. **Location:** Centre for Primary Care and Public Health, Barts and the London School of Medicine and Dentistry; King's Health Partners.	**Purpose:** This article describes a transferable methodology that was developed to guide the evaluation of a three-year follow-up of a large health care change program in London, which took place during a period of economic turbulence and rapid policy change. **Findings:** Some but not all services introduced in the original transformation effort of 2004 –2008 were still running; others had ceased or been altered substantially to accommodate contextual changes (e.g., in case mix, commissioning priorities, or national policies). Key cultural changes (e.g., quality improvement, patient centeredness) largely persisted, and innovative ideas and practices had spread elsewhere. To draw causal links between the original program and current activities and outcomes, it was necessary to weave a narrative thread with multiple intervening influences. In particular, against a background of continuous change in the local health system, the sustainability of the original vision and capacity for quality improvement was strongly influenced by (1) stakeholders' conflicting and changing interpretations of the targeted

	health need; (2) changes in how the quality cycle was implemented and monitored; and (3) conflicts in stakeholders' values and what each stood to gain or lose.
Title: Sustainability and Scalability of the Hospital Elder Life Program at a Community Hospital **Published in:** J Am Geriatr Soc 59:359–365, 2011. **Authors:** Fred H. Rubin, Kelly Neal, Kerry Fenlon, Shuja Hassan, and Sharon K. Inouye. **Location:** Department of Medicine, University of Pittsburgh Medical Center Shadyside Hospital, Pittsburgh, Pennsylvania; Aging Brain Center, Institute for Aging Research, Hebrew Senior Life, Boston, Massachusetts; and Department of Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts.	**Purpose/ Conclusion:** The Hospital Elder Life Program (HELP), an effective intervention to prevent delirium in older hospitalized adults, has been successfully replicated in a community teaching hospital as a quality improvement project. This article reports on successfully sustaining the program over 7 years and expanding its scale from one to six inpatient units at the same hospital. The program currently serves more than 7,000 older patients annually and is accepted as the standard of care throughout the hospital. Innovations that enhanced scalability and widespread implementation included ensuring dedicated staffing for the program, local adaptations to streamline protocols, continuous recruitment of volunteers, and more-efficient data collection. Outcomes include a lower rate of incident delirium; shorter length of stay (LOS); greater satisfaction of patients, families, and nursing staff; and significantly lower costs for the hospital.
Title: Sustainability in changing clinical practice promotes evidence-based nursing care **Published in:** Journal of Advanced Nursing, 2003 Mar; 41(5):509-18. **Authors:** Lars Wallin, Anne-Marie Bostrom, Karin Wikblad and Uwe Ewald. **Location:** Department of Women's and Children's Health and Public Health and Caring Sciences, Uppsala University, Uppsala, Sweden;	**Purpose:** To examine the relationship between sustained work with quality improvement (QI) and factors related to research utilization in a group of nurses. **Findings:** Most nurses (80–90%) had a positive attitude to research. Those who had continued the QI work over a 4-year period reported more activity in searching research literature compared with those who had discontinued the QI work (P ¼ 0Æ005). The QI-sustainable nurses also reported more frequent participation in research-related activities, particularly in implementing specific research findings in practice (P ¼ 0Æ001). Some contextual differences were reported: the QI-sustainable nurses were more likely to obtain support from their chief executive (P ¼ 0Æ001), consultation from a skilled researcher (P ¼ 0Æ005) and statistical support (P ¼ 0Æ001). Within the

Dalarna University College, Falun, Sweden, Lecturer, Department of Nursing, Karolinska Institute, Stockholm, Sweden, Department of Welfare and Care, Faculty of Health Sciences, Linkoping University, Norrkoping, Sweden	broader health care organization, the existence of a research committee and a research and development strategy, as well as access to research assistant staff, had a tendency to be more common for nurses who had continued the QI work.
Title: Systems Antecedents for Dissemination and Implementation: A Review and Analysis of Measures. **Published in:** Health Education & Behavior 39(1) 87–105, 2012. **Authors:** Karen M. Emmons, Bryan Weiner, Maria Eulalia Fernandez, and Shin-Ping Tu. **Location:** Cancer Institute/Harvard School of Public Health, Boston, MA, USA; University of North Carolina at Chapel Hill, Chapel Hill, NC, USA; University of Texas Health Sciences Center at Houston, Houston, TX, USA; University of Washington, Seattle, WA, USA.	**Purpose:** This manuscript identifies and evaluates available measures for five key organizational-level constructs: (a) leadership, (b) vision, (c) managerial relations, (d) climate, and (e) absorptive capacity. **Findings:** Overall the picture was the same across the five constructs—no measure was used in more than one study, many studies did not report the psychometric properties of the measures, some assessments were based on a single response per unit, and the level of the instrument and analysis did not always match. One must seriously consider the development and evaluation of a robust set of measures that will serve as the basis of building the field, allow for comparisons across organizational types and intervention topics, and allow a robust area of dissemination and implementation research to develop.
iv)	**Collaborative Networks**
Title: Collaborative Networks for Both Improvement and Research. **Published in:** Pediatrics 2013;131: S210–S214. **Authors:** Carolyn M. Clancy, Peter A. Margolis, and Marlene Miller. **Location:** Agency for Healthcare Research and Quality, Rockville, Maryland; Cincinnati Children's	**Description:** Moving significant therapeutic discoveries beyond early biomedical translation or T1 science and into practice involves: (1) T2 science, identifying "the right treatment for the right patient in the right way at the right time" (eg, patient-centered outcomes research) and tools to implement this knowledge (eg, guidelines, registries); and (2) T3 studies addressing how to achieve health care delivery change. Collaborative improvement networks can serve as largescale, health system laboratories to engage clinicians, researchers, patients, and parents in

Hospital Medical Center, Cincinnati, Ohio; Children's Hospital Association, Alexandria, Virginia; and Johns Hopkins Children's Center, Baltimore, Maryland.	testing approaches to translate research into practice. Improvement networks are of particular importance for pediatric T2 and T3 research, as evidence to establish safety and efficacy of therapeutic interventions in children is often lacking.
Title: Collaborative Rural Healthcare Network: A Conceptual Model. **Published in:** iJIM – Volume 5, Issue 3, July 2011. **Authors:** U. Raja, D. J. McManus, J.M. Hardin and B. C. Haynes. **Location:** The University of Alabama, Tuscaloosa, USA.	**Purpose:** Healthcare is a critical issue in rural communities throughout the world. Provision of timely and cost effective health care in these communities is a challenge since it is coupled with a lack of adequate infrastructure and manpower support. Shortage of health care personnel and the lack of equipment and facilities often force rural residents to travel long distances to receive needed medical treatment. Researchers and practitioners are in search of solutions to address these unique challenges. In this research, we present a proposed collaborative model of a health information system for rural communities and the challenges and opportunities of this global issue.
Title: Pediatric collaborative improvement networks: background and overview. **Published in:** Pediatrics 2013;131:S189–S195 **Authors:** Lannon, Carole M, Peterson, Laura E. **Location:** Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio; and Health Care Consultant, Boston, Massachusetts.	**Purpose:** By using successful subspecialty initiatives as exemplars, and features of the Institute for Healthcare Improvement's Breakthrough Series model, currently 9 of 14 pediatric subspecialties have implemented collaborative network improvement efforts. Key components include a common aim to improve care; national multicenter prospective collaborative improvement efforts; reducing unnecessary variation by identifying, adopting, and testing best practices; use of shared, valid, high-quality real-time data; infrastructure support to apply improvement science; and public sharing of outcomes. As a key distinguisher from time-limited collaboratives, ongoing pediatric collaborative improvement networks begin with a plan to persist until aims are achieved and improvement is sustained.
Title: Scalable Collaborative Infrastructure for a Learning Healthcare System (SCILHS): Architecture. **Published in:** J Am Med Inform Assoc 2014;21:615–620. **Authors:** Mandl, Kenneth D; Kohane,	**Purpose:** We describe the architecture of the Patient Centered Outcomes Research Institute (PCORI) funded Scalable Collaborative Infrastructure for a Learning Healthcare System (SCILHS, http://www.SCILHS.org) clinical data research network, which leverages the $48 billion dollar federal investment in health information technology (IT) to enable a query able semantic data model across 10 health

Isaac S; McFadden, Douglas; Weber, Griffin M; Natter, Marc; Mandel, Joshua; Schneeweiss, Sebastian; Weiler, Sarah; Klann, Jeffrey G; Bickel, Jonathan; Adams, William G; Ge, Yaorong; Zhou, Xiaobo; Perkins, James; Marsolo, Keith; Bernstam, Elmer; Showalter, John; Quarshie, Alexander; Ofili, Elizabeth; Hripcsak, George; Murphy, Shawn N. **Location:** National Research Network.	systems covering more than 8 million patients, plugging universally into the point of care, generating evidence and discovery, and thereby enabling clinician and patient participation in research during the patient encounter. Central to the success of SCILHS is development of innovative 'apps' to improve PCOR research methods and capacitate point of care functions such as consent, enrollment, randomization, and outreach for patient-reported outcomes. SCILHS adapts and extends an existing national research network formed on an advanced IT infrastructure built with open source, free, modular components.

4. DISCUSSION

Analysis of selected papers shows that literature on sustainability and continuous improvement presents improvement efforts in their initial stages interspersed with strategies in education and staff development, as well as a critical approach applying improvement science and a concern to provide scientific background for evidence-based continuous improvements. Moreover, this search also brought information about collaborative networks designed for both improvement and research purposes.

Each of the following sections presents a different approach to these subjects. For instance, articles classified under the i) Human Resource Performance and Training section describe about team working performance in United Kingdom [9], leadership development for improvement and online training for the public health workforce. Secondly, articles under the ii) Quality Improvement Programs section depict design, implementation and results of improvement efforts in a children's hospital in Tehran, in a Community Mental Health, in Primary Care Teams, or in specific processes, such as the quality-improvement project for intravenous infusion pumps [10-14]. Also in this section, two articles present a concern in providing a theoretically based and integrated framework for evidence-based improvement efforts. While the first develops a comprehensive scheme for improving intensive care [15], the second explores the application of this framework to a complex healthcare collaborative, the MRSA infection control project [11].

Furthermore, in the iii) Sustainability section, studies outline factors that support quality improvement (QI) initiatives. From a Nursing perspective, professional engagement in QI processes was significantly related to "a supportive leadership, facilitative human resources, increased activity in seeking new research and enhanced implementation of research findings in clinical practice" [16]. This article also showed that 80-90% of nurses had a positive attitude towards research, willing to perform evidence-based practice. In this sense, Emmos et al (2012) specified features of organizations that affect implementation of evidence-

based interventions: "(a) leadership, (b) vision, (c) managerial relations, (d) climate, and (e) absorptive capacity" [17]. In this study, authors highlight the need to deepen their analysis, suggesting the development of a set of measures to allow comparisons across organizational types and intervention topics [17].

Accordingly, Greenhalgh et al (2012) report a case study of the sustainability of whole-system change in London [18]. After the original transformation effort from 2004 to 2008, health services had to adapt to contextual changes. Nevertheless, key cultural changes persisted in the system, such as quality improvement and patient centeredness, along with innovative ideas and practices. Authors describe this case study as a "narrative thread with multiple intervening influences" between the original program and current activities and outcomes. Most important, Greenhalgh et al (2012) conclude that "the sustainability of the original vision and capacity for quality improvement was strongly influenced by (1) stakeholders' conflicting and changing interpretations of the targeted health need; (2) changes in how the quality cycle was implemented and monitored; and (3) conflicts in stakeholders' values and what each stood to gain or lose". In other words, stakeholders play a major role in sustaining improvement efforts. Additionally, another analysis of a sustainable improvement program highlights that success factors included: "ensuring dedicated staffing for the program, local adaptations to streamline protocols, continuous recruitment of volunteers, and more-efficient data collection", combined with higher patient and professional satisfaction, better patient outcomes, reduction of incidents and unnecessary costs [19].

Last but not least, the forth section provides conceptual framework, proposals and reports on Collaborative Networks. As described by Clancy et al (2013), these networks allow (a) establishment of guidelines focusing in patient-centered outcomes, (b) multidisciplinary engagement to transform research into practice, (c) higher levels of efficiency and safety in therapeutic interventions, (d) new knowledge in near real-time [20]. Especially for Pediatrics, this strategy provides large study samples to support research and improve reliability in decision making. Moreover, this integrated system allows analyzing improvements in different settings and combinations, providing reliable data about each intervention. According to Raja et al (2011), a collaborative network could also be implemented in a rural community, potentially capable of overcoming global challenges and fostering opportunities in this setting [21]. Also, Mandl et al (2014) report about a scalable Collaborative Network for learning healthcare system between institutes, health services and universities throughout the United States, allowing the development and application of innovative tools, such as 'apps' for healthcare, education and research purposes [22-28].

5. CONCLUSION
Initially, this research aimed to focus only in the lean healthcare literature. Nevertheless, lean principles and tools are based in patient-centeredness, value-added processes, waste reduction and respect for people. Quality improvement efforts may combine these principles without directly referring to a Lean framework or to any specific methodology. Therefore, this study included all improvement initiatives that depicted strategies to sustain continuous improvement, whether in terms of human resources

performance and training or through a complex network in scalable systems.

Notwithstanding, reports on improvement implementation draw a parallel when compared to the phases of Lean in Manufacturing, as previously described by (Stone, 2012): Dissemination phase, Implementation phase, Enterprise phase, and the most recent phase of Performance. Articles described in this review present initial implementation reports, as well as a historical analysis of a whole-system change and scalable networks for combined efforts. In all stages, authors highlight the need to define a robust set of measures to assess interventions, how they work in different setting and under different combinations. One could conclude in this scenario that improvement initiatives have reached the phase of Performance – when there is an urgent need to assess and review processes, with a continuously increasing body of new projects starting the cycle of Dissemination-Implementation-Enterprise-Performance phases.

In this sense, this literature review shows a growing concern to provide a reliable framework for evidence-based improvements, combined with innovation and a system wide approach. Advances in communication technology allow a closer relationship and information sharing between world-class centers to address global health issues. Thus, the establishment of collaborative networks, both for research and healthcare assistance, could be defined as a disruptive innovation to sustain continuous improvement, information sharing and knowledge construction in near real-time worldwide.

6. RESEARCH LIMITATIONS
The literature review was limited to articles available to the researcher using search terms as previously described: 'sustainability' and 'continuous improvement', including articles that referred to: 'improvement initiative', 'lean thinking' and 'Healthcare'.

7. ORIGINALITY/VALUE
Publications tracing the lineage of continuous improvement efforts over the past decade are sparse, exposing a void in the knowledge base. This literature review should assist other scholars and practitioners who are interested in substantiating their improvement efforts.

8. FUNDING

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