Use of indoor location technologies in healthcare contexts: a scoping review protocol

Uso de tecnologias de localização *indoor* em contextos de saúde: protocolo de revisão de escopo

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ABSTRACT

Introduction: Healthcare institutions seek performance improvement through methodologies like Lean healthcare. Despite technological advancements, indoor location tools remain underutilized. Yet, they promise efficiency gains, streamlined workflows, and cost reductions. **Objective:** This review aims to explore indoor location technologies in healthcare. It seeks to understand the research landscape, identify influential authors, institutions, and countries, and evaluate prevalent technologies and their adoption. It also investigates factors contributing to success or failure in published works. **Methods:** Following PRISMA guidelines, this review will search six databases. Two reviewers will independently extract data from selected studies, presenting results through narrative summaries, graphics, and tables. **Conclusion:** It is expected to provide a comprehensive insight into indoor location technology usage in healthcare, addressing critical aspects for future solution development.

Keywords: Workflow; Health Services; Patient Identification Systems; Remote Sensing Technology; Geographic Information Systems.

RESUMO

Introdução: Instituições de saúde buscam melhorias de desempenho por meio de metodologias como o *Lean healthcare*. Apesar dos avanços tecnológicos, as ferramentas de localização *indoor* permanecem subutilizadas. No entanto, elas prometem ganhos de eficiência, fluxos de trabalho otimizados e redução de custos. **Objetivo:** Esta revisão visa explorar as tecnologias de localização *indoor* na área da saúde. Ela busca entender o panorama da pesquisa, identificar autores, instituições e países influentes, e avaliar as tecnologias prevalentes e sua adoção. Também investiga os fatores que contribuem para o sucesso ou fracasso em trabalhos publicados. **Métodos:** Seguindo as diretrizes PRISMA, esta revisão buscará em seis bases de dados. Dois revisores extrairão dados de estudos selecionados de forma independente, apresentando os resultados por meio de resumos narrativos, gráficos e tabelas. **Conclusão:** Espera-se fornecer uma visão abrangente sobre o uso de tecnologia de localização *indoor* em saúde, abordando aspectos críticos para o desenvolvimento de futuras soluções.

Palavras-chave: Fluxo de Trabalho; Serviços de Saúde; Sistemas de Identificação de Pacientes; Tecnologia de Sensoriamento Remoto; Sistemas de Informação Geográfica.

INTRODUCTION

Healthcare institutions are characterized by high complexity, involving various resources and stakeholders working to ensure service quality[1]. Diverse approaches have been employed to reduce costs and enhance service quality, including lean healthcare[2]. In the lean context, many initiatives commence with the mapping of hospital streams using tools such as process mapping[3]. However, in the medical domain, this proves intricate due to challenges posed by diverse databases and unstructured data[4].

Since the advent of the COVID-19 pandemic, there has been a surge in technology adoption in healthcare, encompassing both patient care and supportive functions[5]. One such technological application for automatic process mapping is process mining, which identifies flows through the analysis of computer system data. Nevertheless, this approach often encounters hurdles related to hospital systems and databases[6]. Another approach involves patient and resources localization using tools like Bluetooth and sensor fusion[7-8]. However, there exists a variety of solutions from different providers, each with its associated costs. While some studies compare specific technologies in certain cases, the current literature lacks a comprehensive overview of existing technologies, their advantages, and disadvantages. This knowledge gap can impede healthcare managers in selecting the most suitable tool.

In this context, researchers posit that the utilization of technologies to record patients' process time and flows in healthcare settings holds the potential to enhance service quality, reduce waste, and improve economic aspects for institutions[9]. Furthermore, this aspect has not been thoroughly explored in scientific research. Therefore, the proposed review aims to analyze the current landscape of the use of these technologies, enabling future research to delve into their advantages and disadvantages in detail.

Hence, this protocol outlines the procedures the authors will employ to explore various literature bases and identify the utilization of these technologies in healthcare. This research is part of a project aiming to develop these solutions, seeking viable alternatives at lower costs for replicability in different contexts. Also, to the best of the authors' knowledge, there are no other reviews on this topic.

Objectives

As a scoping review, the primary objective of this research is to comprehensively gather, summarize, and integrate scientific research to assist healthcare managers in understanding the application of indoor location technologies. The study aims to provide an overview of publications on the topic, delineating key authors, countries, keywords, and other metadata. Additionally, the researchers aspire to furnish managerial support for decision-making concerning the adoption of indoor location technologies. In essence, the review is guided by three main objectives:

I. Identify and characterize the current state of art concerning indoor healthcare tracking.

II. Identify the technologies utilized for indoor healthcare tracking and the healthcare context in which organizations adopt this technology.

III. Enumerate potential success or failure factors in the adoption process.

Consequently, three research questions, intricately tied to the aforementioned objectives, have been formulated. These questions will serve as a guiding structure for the review:

I. What is the profile and methodological approach of existing research on healthcare indoor location? Who are the main authors, and which countries and institutions contribute significantly to this topic?

II. What technologies are predominant, and in which healthcare context are they typically adopted?

III. Do published works discuss factors contributing to success or failure? If they do, what are these factors?

METHODS

This scoping review will adhere to the guidelines outlined in the PRISMA Extension for Scoping Reviews[10], meticulously applying all relevant procedures. In the final paper, a completed checklist will be presented, delineating the pages where each item was addressed, or providing the respective justifications for exclusion.

Criteria for considering studies for this review

The review will encompass all documents identified through the search strategy, provided they pertain to technological tools for indoor location in healthcare settings. To clarify, the PCC framework (Population, Concept and Context) was adopted by the researchers.

- Population (P): The primary focus of this review is on healthcare organizations or institutions. Inclusion criteria involve studies, articles, and literature specifically centered around indoor location technologies in healthcare settings. Conversely, exclusion criteria pertain to studies unrelated to healthcare, technologies outside the realm of indoor location, or those falling outside the predefined scope.

- Concept (C): Emphasizing indoor location technologies, the inclusion criteria encompass studies exploring the application, implementation, challenges, and benefits of these technologies in healthcare. Conversely, exclusion criteria apply to studies not directly related to indoor location technologies in healthcare settings.

- Context (C): This review primarily centers on contextual factors impacting the adoption and effectiveness of indoor location technologies in healthcare. The inclusion criteria encompass healthcare papers related to indoor location technologies for both patients and materials, utilizing any research methods and presented in English. Conversely, exclusion criteria involve documents in languages other than English, technologies applied outside healthcare settings, and outdoor tracking. Additionally, documents that lack a description of the adopted technology or do not provide full-text access will be excluded.

Regarding the types of study sources and designs, inclusion criteria cover a range of sources, including peer-reviewed articles, conference papers, reports, and grey literature that discuss indoor location technologies in healthcare. Both qualitative and quantitative studies will be considered, and no publication date limitations were applied to the searches. Exclusion criteria are studies lacking relevant data on indoor location technologies in healthcare. Table 1 summarizes the inclusion and exclusion criteria.

Table 1 – Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Population (P)	Studies, articles, and literature focused on indoor location technologies in healthcare settings	Studies unrelated to healthcare, technologies outside the realm of indoor location, or those falling outside the predefined scope
Concept (C)	Studies exploring the application, implementation, challenges, and benefits of indoor location technologies in healthcare	Studies not directly related to indoor location technologies in healthcare settings
Context (C)	Studies on contextual factors impacting the adoption and effectiveness of indoor location technologies in healthcare, for both patients and materials, using any research methods	Documents with technologies applied outside healthcare settings, outdoor tracking, lack of description of the adopted technology, or no full-text access
Sources and Study Designs	Peer-reviewed articles, conference papers, reports, and grey literature discussing indoor location technologies in healthcare; qualitative and quantitative studies	Studies lacking relevant data on indoor location technologies in healthcare

Search methods for identification of studies

The search strategy was collaboratively developed by two researchers and reviewed by a third to ensure its precision. Additionally, the team adhered to PRESS Guidelines[11] to substantiate the validity of the strategy. Searches will be conducted in the title, abstract, and keywords fields of the designated databases, with necessary adjustments for each search interface. No filters or limiters will be applied to the search, encompassing all identified articles for the initial analysis. The strategy amalgamates health terms, flowchart analysis, and technology, structured with the following Medical Subject Headings (MeSH) terms combined using the "AND" operator:

- (Hospitals OR Health Services OR Health Facilities).
- (Patient Identification Systems OR Geographic Information Systems OR Remote Sensing Technology).
- (Workflow OR Process Assessment, Health Care).

A preliminary search was conducted with these terms to complement the strategy with additional keywords and train reviewers. In addition to MeSH terms, the authors included these terms again as general terms and all synonyms used to achieve a high-sensitivity search. After doing it in the PubMed platform, the authors removed the non-indexed terms, aiming to remove the warnings on the search. Also, some specific technological terms not indexed as MeSH, identified in the preliminary search, were included. The complete query for the PubMed platform is available in Annex I of this protocol to ensure the transparency and replicability of this study. Similar queries adapted for the chosen databases will be employed, aiming to identify documents in health, engineering, technology journals, and grey literature. In total, searches will be conducted in six databases: PubMed, Cochrane, Scopus, Web of Science, Embase/MEDLINE, and Worldwide Science (gray literature). In the authors' understanding, these databases are sufficient for gaining an overview of the topic and addressing the research questions, given the scoping review nature of the research. Moreover, if during the screening new papers are identified that were not in the search results, the authors will include them in the review. Finally, to ensure that the searches are up to date if the final publication is made more than one year after the initial search, the authors will redo the searches and add newly identified documents.

Data collection and analysis

The articles identified through the search strategy will undergo an initial analysis based on title and abstract by a minimum of two independent researchers, organized in three pairs. In case of discordance, a third senior investigator will arbitrate. To ensure the alignment, before the screening starts the reviewers will meet to align inclusion and exclusion criteria, and best practices and clarify any doubts. Subsequently, the documents will undergo a comprehensive analysis using the same procedure to extract

the information necessary to address the research questions. This information will be extracted with the aid of a spreadsheet, with the fields indicated in Table 2. If the researcher's considerer it necessary, they will try to contact the authors of the studies for supplementary information.

Table 2 – Data extraction instrument

Field	Description
ID	Unique identification of the study
Title	Title of the study
Authors	Names of the authors
Year	Year of publication
Abstract only?	Indicates if the document is only an abstract (Yes/No)
Objectives	Objectives of the study
Research question	Research questions of the study
Methods/Study design	Methods and study design
Method replicated?	Indicates if the method was replicated (Yes/No)
Type of institution	Type of institution where the study was conducted
Hospital area	Specific area of the hospital where the technology was used
Technologies used	Indoor location technologies used in the study
Code address	Address of the code used, if available
Flows measured	Flows measured by the study
Variables measured	Variables measured in the study
Results	Results found by the study
Difficulties/Limitations	Difficulties and limitations encountered during the study
Success factors	Factors that contributed to the successful implementation of the technology
Effect measures	Effect measures observed in the study
Conclusions/Findings	Conclusions and findings of the study
Comments	Additional comments about the study

The data obtained from the documents will be presented through tables and narrative descriptions to provide a comprehensive overview of the review's theme. The research aims to deliver a summary of the existing literature on indoor location in healthcare settings, correlating the gathered information with the research questions and objectives outlined in this protocol. Additionally, the authors intend to conduct bibliometric analyses to enhance the understanding of the publication landscape. Finally, potential avenues for future research will be identified based on the identified gaps in the literature. As scoping reviews do not mandate an evaluation of study quality[10], the authors do not intend to appraise the quality of the selected studies.

Data Management

To manage the collected data, three tools will be employed: Mendeley©, Rayyan©, and Google Drive©. Mendeley©, a free reference manager, will assist in organizing references. Rayyan©, a research collaboration tool, will facilitate a blind review process among different reviewers. Google Drive© will serve as a platform for sharing and collaborating on online files, including summary tables and the research manuscript document. Throughout the investigation, all nine researchers involved in the review (comprising six junior researchers and three seniors) will have access to the documents and databases.

Expected Results and Conclusions

In summary, this scoping review aims to understand the use of indoor location technologies in the healthcare context, outlining existing approaches, their limitations, and key benefits. It is expected that this will guide future research in developing solutions for mapping and analyzing flows, integrating Industry 4.0 technologies.

Given the complexity of healthcare institutions, there are numerous opportunities for implementing new technologies. Therefore, this review can contribute to advancing applied research, driving innovation in a sector of great practical and theoretical importance.

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Conflicts of Interest

The authors declare that there were no conflicts of interest in the conception of this work.

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APPENDICES

Appendix I – Search strategy

Table 3 – Search strategy on PubMed – June 18th, 2024

Search Strategy	Search Terms
#1	("Hospitals"[MeSH Terms] OR "Hospitals" OR "Hospital") OR ("hospitals, high volume"[MeSH Terms] OR "hospitals, high volume" OR "High-Volume Hospital" OR "Hospital, High-Volume" OR "Hospitals, High Volume" OR "High-Volume Hospitals" OR "High Volume Hospitals") OR ("hospitals, low volume"[MeSH Terms] OR ("hospitals, low volume" OR "Hospital, Low-Volume" OR "Hospitals, Low Volume" OR "Low-Volume Hospital" OR "Low-Volume Hospitals" OR "Low Volume Hospitals") OR ("hospitals, isolation"[MeSH Terms] OR "hospitals, isolation" OR "Hospital, Isolation" OR "Isolation Hospital" OR "Isolation Hospitals" OR "Stations, Quarantine" OR "Quarantine Station" OR "Quarantine Stations" OR "Station, Quarantine" OR "Lazarettos" OR "Lazaretto") OR ("hospitals, religious"[MeSH Terms] OR "hospitals, religious" OR "Religious Hospitals" OR "Hospital, Religious" OR "Religious Hospital") OR ("hospitals, private"[MeSH Terms] OR "hospitals, private" OR "Private Hospitals" OR "Hospital, Private" OR "Private Hospital") OR ("hospitals, voluntary"[MeSH Terms] OR "hospitals, voluntary" OR "Private, Not-for-Profit Hospitals" OR "Private, Not for Profit Hospitals" OR "Voluntary Hospitals" OR "Hospital, Voluntary" OR "Voluntary Hospital") OR ("hospitals, veterans"[MeSH Terms] OR "hospitals, veterans" OR "Veterans Hospitals" OR "Hospital, Veterans" OR "Veterans Hospital") OR ("hospitals, urban"[MeSH Terms] OR "hospitals, urban" OR "Urban Hospitals" OR "Hospital, Urban" OR "Urban Hospital" OR "Hospitals, Metropolitan" OR "Metropolitan Hospitals" OR "Hospital, Metropolitan" OR "Metropolitan Hospital" OR "City Hospitals" OR "City Hospital" OR "Hospital, City" OR "Hospitals, City") OR ("hospitals, university"[MeSH Terms] OR "hospitals, university" OR University Hospitals) OR ("hospitals, teaching"[MeSH Terms] OR "hospitals, teaching" OR "Hospital, Teaching" OR "Teaching Hospital" OR "Teaching Hospitals") OR ("hospitals, state"[MeSH Terms] OR "hospitals, state" OR "State Hospitals" OR "Hospital, State" OR "State Hospital") OR ("hospitals, special"[MeSH Terms] OR "hospitals, special" OR "Special Hospital" OR "Hospital, Special" OR "Special Hospitals") OR ("hospitals, satellite"[MeSH Terms] OR "hospitals, satellite" OR "Hospitals, Branch" OR "Satellite Hospitals" OR "Hospital, Satellite" OR "Satellite Hospital" OR "Branch Hospitals" OR "Branch Hospital" OR "Hospital, Branch") OR ("hospitals, rural"[MeSH Terms] OR "hospitals, rural" OR "Rural Hospitals" OR "Hospital, Rural" OR "Rural Hospital") OR ("hospitals, public"[MeSH Terms] OR "hospitals, public" OR "Public Hospitals" OR "Hospital, Public" OR "Public Hospital") OR ("hospitals, psychiatric"[MeSH Terms] OR "hospitals, psychiatric" OR "Psychiatric Hospitals" OR "Hospital, Psychiatric" OR "Psychiatric Hospital" OR "Mental Institutions" OR "Institution, Mental" OR "Institutions, Mental" OR "Mental

Institution" OR "Hospitals, Mental" OR "Hospital, Mental" OR "Mental Hospital" OR "Mental Hospitals") OR ("hospitals, proprietary"[MeSH Terms] OR "hospitals, proprietary" OR "Proprietary Hospitals" OR "Hospital, Proprietary" OR "Proprietary Hospital" OR "Private, for-Profit Hospitals" OR "Private, Investor-Owned Hospitals" OR "Hospitals, Private, for-Profit") OR ("hospitals, pediatric"[MeSH Terms] OR "hospitals, pediatric" OR "Pediatric Hospitals" OR "Hospital, Pediatric" OR "Pediatric Hospital") OR ("hospitals, packaged"[MeSH Terms] OR "hospitals, packaged" OR "Packaged Hospitals" OR "Hospital, Packaged" OR "Packaged Hospital") OR ("hospitals, osteopathic"[MeSH Terms] OR "hospitals, osteopathic" OR "Osteopathic Hospitals" OR "Hospital, Osteopathic" OR "Osteopathic Hospital") OR ("hospitals, municipal"[MeSH Terms] OR "hospitals, municipal" OR "Municipal Hospitals" OR "Hospital, Municipal" OR "Municipal Hospital") OR ("hospitals, military"[MeSH Terms] OR "hospitals, military" OR "Hospital, Military" OR "Military Hospital" OR "Military Hospitals" OR "Navy Hospitals" OR "Hospital, Navy" OR "Navy Hospital" OR "Hospitals, Air Force" OR "Air Force Hospital" OR "Hospital, Air Force" OR "Air Force Hospitals" OR "Army Hospital" OR "Hospital, Army" OR "Army Hospitals") OR ("hospitals, maternity"[MeSH Terms] OR "hospitals, maternity" OR "Maternity Hospitals" OR "Hospital, Maternity" OR "Maternity Hospital") OR ("hospitals, group practice"[MeSH Terms] OR "hospitals, group practice" OR "Group Practice Hospitals" OR "Group Practice Hospital" OR "Hospital, Group Practice" OR "Practice Hospital, Group") OR ("hospitals, general"[MeSH Terms] OR "hospitals, general" OR "General Hospital" OR "General Hospitals" OR "Hospital, General") OR ("hospitals, federal"[MeSH Terms] OR "hospitals, federal" OR "Federal Hospital" OR "Federal Hospitals" OR "Hospital, Federal") OR ("hospitals, district"[MeSH Terms] OR "hospitals, district" OR "District Hospitals" OR "District Hospital" OR "Hospital, District") OR ("hospitals, county"[MeSH Terms] OR "hospitals, county" OR "County Hospitals" OR "County Hospital" OR "Hospital, County") OR ("hospitals, convalescent"[MeSH Terms] OR "hospitals, convalescent" OR "Convalescent Hospital" OR "Convalescent Hospitals" OR "Hospital, Convalescent") OR ("hospitals, community"[MeSH Terms] OR "hospitals, community" OR "Community Hospital" OR "Community Hospitals" OR "Hospital, Community") OR ("hospitals, chronic disease"[MeSH Terms] OR "hospitals, chronic disease" OR "Chronic Disease Hospital" OR "Hospital, Chronic Disease" OR "Chronic Disease Hospitals" OR "Hospitals, Tuberculosis" OR "Hospital, Tuberculosis" OR "Tuberculosis Hospital" OR "Tuberculosis Hospitals" OR "Tuberculosis Sanitoria") OR ("hospitals, animal"[MeSH Terms] OR "hospitals, animal" OR "Animal Hospital" OR "Hospital, Animal" OR "Hospitals, Veterinary" OR "Hospital, Veterinary" OR "Veterinary Hospital" OR "Veterinary Hospitals" OR "Animal Hospitals" OR "Veterinary Clinics" OR "Clinics, Veterinary" OR "Clinic, Veterinary" OR "Veterinary Clinic") OR ("hospitals, rehabilitation"[MeSH Terms] OR "hospitals, rehabilitation" OR "Rehabilitation Hospitals" OR "Hospital, Rehabilitation") OR ("Tertiary Care Centers"[MeSH Terms] OR "Tertiary Care Centers" OR "Care Center, Tertiary" OR "Center, Tertiary Care" OR "Centers, Tertiary Care" OR "Tertiary Care Center" OR "Tertiary Referral Center" OR "Center, Tertiary Referral" OR "Centers, Tertiary Referral" OR "Tertiary Referral Centers" OR "Tertiary Referral Hospital" OR "Hospital, Tertiary Referral" OR "Hospitals, Tertiary Referral" OR "Referral Hospital, Tertiary" OR "Tertiary Referral

	Hospitals" OR "Tertiary Hospital" OR "Hospital, Tertiary" OR "Hospitals, Tertiary" OR "Tertiary Hospitals") OR ("Mobile Health Units"[MeSH Terms] OR "Mobile Health Units" OR "Health Units, Mobile" OR "Mobile Health Unit" OR "Mobile Clinics" OR "Clinic, Mobile" OR "Clinics, Mobile" OR "Mobile Clinic" OR "Mobile Health Vans" OR "Mobile Health Van" OR "Van, Mobile Health" OR "Field Hospitals" OR "Field Hospital" OR "Hospital, Field" OR "Hospitals, Field" OR "Mobile Hospitals" OR "Hospital, Mobile" OR "Hospitals, Mobile" OR "Mobile Hospital") OR ("Safety-net Providers"[MeSH Terms] OR "Safety-net Providers" OR "Provider, Safety-net" OR "Providers, Safety-net" OR "Safety net Providers" OR "Safety-net Provider" OR "Safety-net Clinics" OR "Clinic, Safety-net" OR "Clinics, Safety-net" OR "Safety net Clinics" OR "Safety-net Clinic" OR "Safety-net Hospitals" OR "Hospital, Safety-net" OR "Hospitals, Safety-net" OR "Safety net Hospitals" OR "Safety-net Hospital") OR ("Secondary Care Centers"[MeSH Terms] OR "Secondary Care Centers" OR "Care Center, Secondary" OR "Care Centers, Secondary" OR "Center, Secondary Care" OR "Centers, Secondary Care" OR "Secondary Care Center" OR "Secondary Referral Hospital" OR "Hospital, Secondary Referral" OR "Hospitals, Secondary Referral" OR "Referral Hospital, Secondary" OR "Secondary Referral Hospitals" OR "Secondary Care Facility" OR "Care Facilities, Secondary" OR "Care Facility, Secondary" OR "Secondary Care Facilities" OR "Secondary Referral Center" OR "Referral Center, Secondary" OR "Secondary Referral Centers") OR ("Cancer Care Facilities"[MeSH Terms] OR "Cancer Care Facilities" OR "Cancer Care Facility" OR "Hospitals, Cancer" OR "Cancer Hospital" OR "Cancer Hospitals" OR "Hospital, Cancer") OR ("Joint Commission on Accreditation of Healthcare Organizations"[MeSH Terms] OR "Joint Commission on Accreditation of Healthcare Organizations" OR "JCAHO" OR "Joint Commission on Accreditation of Health Care Organizations" OR "Joint Commission on Accreditation of Hospitals"))
#2	(("Health Services"[MeSH Terms] OR "Health Services" OR "Health Service" OR "Services, Health") OR ("Health Services for Persons with Disabilities"[MeSH Terms] OR "Health Services for Persons with Disabilities" OR "Health Services for the Disabled" OR "Health Services for People with Disabilities" OR "Health Services for Disabled Persons") OR ("Health Services for Transgender Persons"[MeSH Terms] OR "Health Services for Transgender Persons" OR "Health Services for Transgendered Persons") OR ("Reproductive Health Services"[MeSH Terms] OR "Reproductive Health Services" OR "Health Service, Reproductive" OR "Health Services, Reproductive" OR "Reproductive Health Service" OR "Service, Reproductive Health" OR "Services, Reproductive Health") OR ("Urban Health Services"[MeSH Terms] OR "Urban Health Services" OR "Health Services, Urban" OR "Urban Health Service" OR "Services, Urban Health") OR ("Suburban Health Services"[MeSH Terms] OR "Suburban Health Services" OR "Suburban Health Service") OR ("Rural Health Services"[MeSH Terms] OR "Rural Health Services" OR "Health Services, Rural" OR "Health Service, Rural" OR "Rural Health Service" OR "Services, Rural Health" OR "Rural Health Center" OR "Center, Rural Health" OR "Centers, Rural Health" OR "Health Center, Rural" OR "Health Centers, Rural" OR "Rural Health Centers") OR ("Adolescent Health Services"[MeSH Terms] OR "Adolescent Health Services" OR "Services, Adolescent Health" OR "Adolescent Health Service" OR "Health Service, Adolescent" OR "Service, Adolescent Health" OR "Health Services, Adolescent") OR

("Women's Health Services"[MeSH Terms] OR "Women's Health Services" OR "Health Service, Women's" OR "Service, Women's Health" OR "Women Health Services" OR "Women's Health Service" OR "Health Services, Woman" OR "Health Services, Women's" OR "Health Services, Women" OR "Services, Women's Health") OR ("United States Substance Abuse and Mental Health Services Administration"[MeSH Terms] OR "United States Substance Abuse and Mental Health Services Administration" OR "SAMHSA" OR "Substance Abuse and Mental Health Services Administration (U.S.)" OR "Health Services and Mental Health Administration" OR "Alcohol, Drug Abuse, and Mental Health Administration") OR ("Student Health Services"[MeSH Terms] OR "Student Health Services" OR "Health Services, Student" OR "Health Service, Student" OR "Student Health Service" OR "Health Services, University" OR "Health Service, University" OR "Service, University Health" OR "University Health Service" OR "University Health Services" OR "Services, University Health") OR ("School Health Services"[MeSH Terms] OR "School Health Services" OR "Health Service, School" OR "School Health Service" OR "Service, School Health" OR "School-Based Services" OR "School Based Services" OR "School-Based Service" OR "Service, School-Based" OR "Services, School-Based" OR "Services, School Health" OR "School-Based Health Services" OR "Health Service, School-Based" OR "Health Services, School-Based" OR "School Based Health Services" OR "School-Based Health Service" OR "Services, School-Based Health" OR "Health Services, School" OR "School Health Promotion" OR "Health Promotion, School" OR "Promotion, School Health") OR ("Preventive Health Services"[MeSH Terms] OR "Preventive Health Services" OR "Preventive Health Care" OR "Care, Preventive Health" OR "Health Care, Preventive" OR "Services, Preventive Health" OR "Preventive Health" OR "Health, Preventive" OR "Health Services, Preventive" OR "Health Service, Preventive" OR "Preventive Health Service" OR "Preventive Health Programs" OR "Health Program, Preventive" OR "Health Programs, Preventive" OR "Preventive Health Program" OR "Program, Preventive Health" OR "Programs, Preventive Health" OR "Preventive Programs" OR "Preventive Program" OR "Program, Preventive" OR "Programs, Preventive") OR ("Personal Health Services"[MeSH Terms] OR "Personal Health Services" OR "Health Services, Personal" OR "Health Service, Personal" OR "Personal Health Service" OR "Service, Personal Health" OR "Services, Personal Health") OR ("Occupational Health Services"[MeSH Terms] OR "Occupational Health Services" OR "Services, Employee Health" OR "Health Services, Occupational" OR "Health Service, Occupational" OR "Occupational Health Service" OR "Service, Occupational Health" OR "Services, Occupational Health" OR "Health Services, Employee" OR "Employee Health Service" OR "Health Service, Employee" OR "Employee Health Services" OR "Employment-Based Services" OR "Employment Based Services" OR "Employment-Based Service") OR ("Mental Health Services"[MeSH Terms] OR "Mental Health Services" OR "Health Services, Mental" OR "Health Service, Mental" OR "Mental Health Service" OR "Service, Mental Health" OR "Services, Mental Hygiene" OR "Mental Hygiene Service" OR "Mental Hygiene Services" OR "Services, Mental Health") OR ("Maternal Health Services"[MeSH Terms] OR "Maternal Health Services" OR "Health Services, Maternal" OR "Health Service, Maternal" OR "Maternal Health Service" OR "Services, Maternal Health") OR ("Marketing of Health Services"[MeSH Terms] OR "Marketing of Health Services" OR

"Marketing, Health Services" OR "Health Services Marketing" OR "Marketing Services, Health" OR "Marketing Service, Health") OR ("health services, indigenous"[MeSH Terms] OR "health services, indigenous" OR "Health Indigenous Service" OR "Indigenous Health Services" OR "Health Service, Indigenous" OR "Indigenous Health Service" OR "Services, Indigenous Health") OR ("Health Services Research"[MeSH Terms] OR "Health Services Research" OR "Health Services Evaluation" OR "Evaluation, Health Services" OR "Evaluations, Health Services" OR "Health Services Evaluations" OR "Research, Medical Care" OR "Medical Care Research" OR "Research, Health Services" OR "Health Care Research" OR "Research, Health Care" OR "Healthcare Research" OR "Research, Healthcare" OR "Action Research" OR "Research, Action") OR ("Health Services Needs and Demand"[MeSH Terms] OR "Health Services Needs and Demand" OR "Needs" OR "Target Population" OR "Population, Target" OR "Populations, Target" OR "Target Populations" OR "Health Services Needs" OR "Health Services Need" OR "Need, Health Services" OR "Needs, Health Services") OR ("Health Services Misuse"[MeSH Terms] OR "Health Services Misuse" OR "Health Services Misuses" OR "Misuse, Health Services" OR "Misuse of Health Services" OR "Abuse of Health Services" OR "Health Services Abuse" OR "Health Services Underutilization" OR "Underuse, Health Services" OR "Health Services Underuse") OR ("Health Services for the Aged"[MeSH Terms] OR "Health Services for the Aged" OR "Geriatric Health Services" OR "Health Services for the Elderly" OR "Geriatric Health Service" OR "Health Service, Geriatric" OR "Health Services for Aged") OR ("Health Services Administration"[MeSH Terms] OR "Health Services Administration" OR "Administration, Health Services") OR ("Health Services Accessibility"[MeSH Terms] OR "Health Services Accessibility" OR "Access to Health Services" OR "Access to Care" OR "Access to Cares" OR "Care, Access to" OR "Accessibility of Health Services" OR "Accessibility, Health Services" OR "Availability of Health Services" OR "Health Services Availability" OR "Access To Care, Health" OR "Access to Health Care" OR "Health Services Geographic Accessibility" OR "Access to Therapy" OR "Access to Therapies" OR "Therapy, Access to" OR "Access to Treatment" OR "Access to Treatments" OR "Treatment, Access to" OR "Access to Medicines" OR "Access to Medicine" OR "Medicine, Access to" OR "Medicines, Access to" OR "Access to Medications" OR "Access to Medication" OR "Medication, Access to" OR "Medication Access" OR "Access, Medication" OR "Contraceptive Availability" OR "Availability, Contraceptive" OR "Contraceptive Access" OR "Access, Contraceptive" OR "Contraception Access" OR "Access, Contraception" OR "Access to Contraception" OR "Contraception, Access to" OR "Program Accessibility" OR "Accessibility, Program") OR ("Dental Health Services"[MeSH Terms] OR "Dental Health Services" OR "Health Services, Dental" OR "Dental Health Service" OR "Health Service, Dental" OR "Service, Dental Health" OR "Services, Dental Health") OR ("Community Mental Health Services"[MeSH Terms] OR "Community Mental Health Services" OR "Mental Health Services, Community" OR "Services, Community Mental Health" OR "Community Mental Health Service" OR "Health Services, Community Mental" OR "Assertive Community Treatment" OR "Community Treatment, Assertive") OR ("Community Health Services"[MeSH Terms] OR "Community Health Services" OR "Community Health Service" OR "Health Service, Community" OR "Service, Community Health" OR

"Services, Community Health" OR "Health Services, Community" OR "Community Health Care" OR "Health Care, Community" OR "Community Healthcare" OR "Healthcare, Community") OR ("Child Health Services"[MeSH Terms] OR "Child Health Services" OR "Health Services, Child" OR "Child Health Service" OR "Health Service, Child" OR "Service, Child Health" OR "Services, Child Health" OR "Infant Health Services" OR "Health Services, Infant" OR "Health Service, Infant" OR "Infant Health Service") OR ("Veterans Health Services"[MeSH Terms] OR "Veterans Health Services" OR "Health Service, Veterans" OR "Health Services, Veterans" OR "Veterans Health Service") OR ("Military Health Services"[MeSH Terms] OR "Military Health Services" OR "Health Service, Military" OR "Military Health Service" OR "Military Health System" OR "Health System, Military" OR "Military Health Systems" OR "System, Military Health") OR ("School Mental Health Services"[MeSH Terms] OR "School Mental Health Services" OR "School-Based Mental Health Services" OR "School Based Mental Health Services") OR ("Maternal-Child Health Services"[MeSH Terms] OR "Maternal-Child Health Services" OR "Health Service, Maternal-Child" OR "Maternal Child Health Services" OR "Maternal-Child Health Service" OR "Service, Maternal-Child Health" OR "Services, Maternal-Child Health" OR "Health Services, Maternal-Child" OR "Health Services, Maternal Child") OR ("Medical Overuse"[MeSH Terms] OR "Medical Overuse" OR "Overuse, Medical" OR "Overuse, Health Services" OR "Overutilization of Health Services" OR "Health Services Overutilization" OR "Health Services Overuse" OR "Unnecessary Health Care" OR "Health Care, Unnecessary" OR "Unwanted Medical Care" OR "Preference Misdiagnosis") OR ("National Health Programs"[MeSH Terms] OR "National Health Programs" OR "Health Program, National" OR "Health Programs, National" OR "National Health Program" OR "Program, National Health" OR "Programs, National Health" OR "National Health Insurance" OR "Health Insurance, National" OR "Insurance, National Health" OR "Health Services, National" OR "Health Service, National" OR "National Health Service" OR "Service, National Health" OR "Services, National Health" OR "National Health Services") OR ("Emergency Medical Services"[MeSH Terms] OR "Emergency Medical Services" OR "Emergency Services, Medical" OR "Emergency Service, Medical" OR "Medical Emergency Service" OR "Medical Emergency Services" OR "Service, Medical Emergency" OR "Medical Services, Emergency" OR "Emergency Medical Service" OR "Medical Service, Emergency" OR "Service, Emergency Medical" OR "Services, Emergency Medical" OR "Prehospital Emergency Care" OR "Emergency Care, Prehospital" OR "Emergicenters" OR "Emergicenter" OR "Emergency Care" OR "Emergency Health Services" OR "Emergency Health Service" OR "Health Service, Emergency" OR "Health Services, Emergency" OR "Services, Emergency Health") OR ("Ambulatory Care"[MeSH Terms] OR "Ambulatory Care" OR "Care, Ambulatory" OR "Outpatient Care" OR "Care, Outpatient" OR "Health Services, Outpatient" OR "Health Service, Outpatient" OR "Outpatient Health Service" OR "Outpatient Health Services" OR "Outpatient Services" OR "Outpatient Service" OR "Service, Outpatient" OR "Services, Outpatient" OR "Services, Outpatient Health" OR "Urgent Care" OR "Care, Urgent" OR "Urgent Cares" OR "Clinic Visits" OR "Clinic Visit" OR "Visit, Clinic" OR "Visits, Clinic") OR ("United States Indian Health Service"[MeSH Terms] OR "United States Indian Health Service" OR "Indian Health Service" OR "Health Service, Indian" OR "Indian Health Services" OR "Service, Indian

	Health" OR "Indian Health Service (U.S."))
#3	("Health Facilities"[MeSH Terms] OR "Health Facilities " OR "Facilities, Health" OR "Facility, Health" OR "Health Facility") OR ("health facilities, proprietary"[MeSH Terms] OR "health facilities, proprietary" OR "Proprietary Health Facilities" OR "Privately Sponsored Programs")
#4	("Patient Identification Systems"[MeSH Terms] OR "Patient Identification Systems" OR "Identification System, Patient" OR "Patient Identification System" OR "System, Patient Identification" OR "Systems, Patient Identification" OR "Patient Tracking" OR "Tracking, Patient")
#5	("Remote Sensing Technology"[MeSH Terms] OR "Remote Sensing Technology" OR "Remote Sensing Technologies" OR "technologies remote sensing" OR "technology remote sensing")
#6	("Geographic Information Systems"[MeSH Terms] OR "Geographic Information Systems" OR "Geographic Information System"OR "Information Systems, Geographic" OR "Geographical Information Systems" OR "Geographical Information System" OR "Information Systems, Geographical" OR "System, Geographical Information" OR "Global Positioning Systems" OR "Positioning System, Global" OR "Positioning Systems, Global" OR "System, Global Positioning" OR "Systems, Global Positioning" OR "Global Positioning System")
#7	("RFID" OR "Radio Frequency Identification" OR "BLE" OR "Bluetooth Low Energy" OR "Radiology positioning device" OR "radio frequency identification device" OR "Wi-Fi Sensing" OR "Indoor Navigation" OR (("Wi-fi" OR "Sensor-based" OR "Indoor" OR "Smartphone" OR "Beacon") AND "Tracking"))
#8	("Workflow"[MeSH Terms] OR "Workflow" OR "Workflows" OR "Work Flow" OR "Work Flows")
#9	("Process Assessment, Health Care" [MeSH Terms] OR "Process Assessment, Health Care" OR "Assessment, Process" OR "Assessments, Process" OR "Process Assessment" OR "Process Assessments" OR "Process Assessment (Health Care)" OR "Assessment, Process (Health Care)" OR "Process Measures" OR "Measure, Process" OR "Measures, Process" OR "Process Measure")
Final Query	**(#1 OR #2 OR #3) AND (#4 OR #5 OR #6 OR #7) AND (#8 OR #9)**
Results	468 documents