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Innovations in non-invasive cardiovascular diagnostics: The interplay of nursing, pharmacy, health records, and emergency care in cardiology

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***Abstract*---**Background _ Cardiovascular disease remains the leading cause of mortality and disability in the United States and globally. Despite technological advancements that have improved life expectancy and quality of life, the prevalence of cardiovascular diseases continues to rise, often associated with aging populations experiencing multiple chronic conditions. Current clinical guidelines often neglect the complexity of multimorbidity and the intricacies of

healthcare systems, making their practical implementation challenging. Moreover, care plans frequently fail to consider individual preferences, cultures, and lifestyles that shape a person's social and environmental context, hindering acceptance and effectiveness, particularly among high-risk populations. Aim of Work – The objective of this scientific statement is to provide a comprehensive overview of person-centered care delivery models for specific cardiovascular disorders, emphasizing the features and documented outcomes of these approaches. Methods – A scoping study was conducted using a systematic search of databases including Ovid MEDLINE, Embase.com, Web of Science, CINAHL Complete, Cochrane Central Register of Controlled Trials via Ovid, and ClinicalTrials.gov, covering the period from 2010 to 2017. Various research designs were included that specifically assessed care delivery methods for targeted cardiovascular diseases. Models were selected based on their incorporation of evidence-based recommendations, clinical decision support tools, systematic assessment procedures, and the patient's perspective in shaping treatment plans. Results – The findings revealed significant differences in methodologies, outcome metrics, and care practices across the different models examined. However, there was a notable lack of comprehensive evidence supporting the most effective treatment delivery models, largely due to inconsistencies in approaches, variations in payment structures, and the healthcare system's difficulty in addressing the complex needs of patients with chronic cardiovascular illnesses. Conclusion – There is a pressing need for the development and implementation of person-centered care delivery models that effectively incorporate evidence-based practices and consider the individual needs and preferences of patients. Addressing these elements is crucial for improving outcomes and acceptance of treatment plans, particularly in populations at high risk for cardiovascular disease.

***Keywords*---**Cardiovascular Disease, Person-Centered Care, Multimorbidity, Healthcare Systems, Evidence-Based Practice, Chronic Illness Management.

Introduction

Cardiovascular disease (CVD) continues to be the primary cause of mortality and disability both in the United States and worldwide [1]. Progress in technology and cardiovascular healthcare have resulted in remarkable improvements in life expectancy and overall quality of life. In the setting of a growing elderly population and the prevalence of intricate chronic ailments, it is uncommon for individuals to exhibit just one cardiovascular illness; instead, they often endure several chronic disorders for several decades [2].

Clinical guidelines provide evidence-based advice for the management of a specific risk factor or illness. However, in order to ensure that these recommendations are implemented effectively in practice, it is necessary to adopt a more person-

centered approach to care delivery. This approach takes into account the complex healthcare needs of individuals with chronic cardiovascular disease [3]. Person-centered models of care, by definition, involve three key components: a thorough assessment of the patient's personal story, the development of a care plan that is collaboratively designed by both the patient and the clinician, and a continuous process of reassessment and adjustment of the patient's care goals over time. These models also consider both the individual's internal capacity, such as their physical abilities, skills, and knowledge, as well as their external capacity, which includes factors such as financial resources, community support, lifestyle, and cultural considerations [4-6].

The funding of health care adds more complexity to the delivery of treatment, since it involves competing payment incentives and inaccurate quality metrics based on value, which frequently place a burden on physicians, patients, and their families. Several governmental agencies and professional associations have adopted care models without adequate evidence to demonstrate their effectiveness or address the concerns of policymakers, healthcare professionals, and the public [7-9]. These care models are often labeled inconsistently based on factors such as the healthcare setting, disease, clinician, and payment method, without considering the values and preferences of patients. To obtain optimal health outcomes in complicated, chronic cardiovascular disease, it is necessary to analyze the data about care delivery and identify the key elements of treatment that promote successful results and prioritize the needs of the individual. This document aims to delineate care delivery models for patients following the diagnosis of specific, widely prevalent cardiovascular conditions. It focuses on the attributes of care delivery structure and process, as well as the outcomes for both health systems and patients. Additionally, it addresses the knowledge gaps and limitations associated with achieving person-centered care.

Models of care

Models of care include the many methods through which healthcare services are provided to people and groups during different phases of health and sickness. Models are ideally created to guarantee that individuals receive appropriate care, at the appropriate time, from the appropriate team, and in the appropriate location [10]. The design and execution of these models are typically in line with the strategic objectives of an organization or system. They consider the population being served, as well as how patients move within the system and the financing methods for care across different settings. Effective models of care require several essential elements, such as evidence-based practices, utilization of clinical decision support tools, continuous evaluation through quality improvement processes, and collaborative efforts to prioritize health needs among clinicians, patients, and their communities [8,11].

Care delivery models are often characterized based on the stage of sickness or disease [12]. Primary prevention models aim to address health risks before the onset of disease, while secondary prevention models concentrate on timely treatment after diagnosis to prevent disease progression. Initially, different models were created to achieve diverse objectives, leading Krumholz et al [13] to develop a taxonomy to assess the delivery of cardiovascular care. Subsequently, care

delivery models have progressed, recognizing the growing prevalence of many chronic conditions and the resulting intricacy of self-care management that patients and families must undertake. Nevertheless, there is currently no universally accepted method for defining care delivery units or systems that comprise a wide range of entities, including individual physician offices and big integrated health systems [14].

The Affordable Care Act implemented the concept of integrated systems that promote collaboration among healthcare professionals and offer rewards for improving care delivery and outcomes. It also expanded performance metrics to include care coordination, population health, safety, patient engagement, and efficiency, which stimulated innovation in care delivery. Encouragement was given to develop processes in different care settings that align with person-centered health goals, going beyond the treatment of a specific disease [15-18].

By acknowledging the interconnectedness of people and health systems, care delivery models have included several techniques to strengthen the collaboration between patients and their healthcare providers. The efficacy of system enhancements, encompassing infrastructure, information technology, clinical decision support, and enhanced communication between care providers and patients, is evaluated based on quality metrics for safety, timeliness, efficiency, effectiveness, equity, and person-centeredness. The focus on aligning these factors with the patient's voice in terms of objectives and preferences has transcended international borders and payment systems. This alignment has also strengthened the need to get a deeper comprehension of how care delivery may systematically tackle the health priorities of people and groups, as specified in the European Cooperation in Science and Technology (COSTCARES) project [8,19,20] (Figure 1).

Methods

The medical librarian (M.L.) performed electronic searches for published literature using several databases including Ovid MEDLINE, Embase.com, Web of Science, CINAHL Complete, Cochrane Central Register of Controlled Trials via Ovid, and ClinicalTrials.gov. The searches were conducted in 2016. The search approach included the use of restricted vocabulary and free-text synonyms to cover the topics of cardiovascular diseases and conditions, care delivery models, outpatient care, and a list of desired outcome measures [21].

Models of care that are based on the involvement and participation of the community

Contemporary community-based models were characterized by establishing connections between specialized and community-based services to address nonacute, low-complexity, and chronic cardiovascular conditions [22-24]. Long-term assessments showed that having a close relationship with patients and maintaining continuity and communication among healthcare professionals improved the patient's experience and health outcomes. For instance, the Primary Care Plus model aimed to decrease unnecessary referrals to outpatient hospital

care by promoting communication and collaboration between medical specialists and general practitioners (GPs). Patients referred to the Primary Care Plus center reported a significantly higher quality of care compared to those receiving the usual hospital-based care [25,26]. Electronic consultations have been found to improve access to specialized care and ultimately improve health outcomes for patients in the community. Gallagher et al. conducted a study evaluating the use of web-based conferencing between general practitioners (GPs) and cardiologists to discuss patients in real time. General practitioners were extended an invitation to submit cases for the purpose of discussion and to get advice for the care of their patients. Out of the 142 examples that were addressed, only 17% needed more examination. While a direct cause-and-effect relationship between virtual consultations and patient outcomes was not shown, enhancing communication between specialists and primary care practitioners seems to offer patients more accessibility and perhaps smoother treatment coordination.

Towfighi and colleagues [27] performed a randomized controlled trial (RCT) to evaluate a community-based care strategy for post-stroke patients. Patients were allocated to a multimodal coordinated care model that included advanced practice professional (APP) clinic appointments, community health worker home visits, and phone call follow-up. This approach was used to conduct protocol-driven risk factor management. This study focused on the challenges of adopting and assessing person-centered care models, specifically in relation to self-management skill development sessions and language adapted educational materials and tools. The scientists failed to show substantial gains, but they did identify the possible confounding influence of diverse care delivery systems as a barrier to understanding favorable health outcomes.

The need for specialized cardiovascular care has led to assessments of different alternative care delivery models, such as informal and lay caregivers at home and other nontraditional settings. Care provided at home was introduced to address both urgent and long-term clinical situations, with the aim of improving self-management and minimizing unnecessary hospitalization. Barber shops and churches served as venues for community-based initiatives, resulting in favorable health outcomes, including enhanced blood pressure regulation and medication supervision. Several comparable methods have been extensively put into practice, but they have not been successfully incorporated into existing models or care systems that allow for the documenting of procedures and monitoring of care results over a period of time [28-30].

The effectiveness of system infrastructure and centralized resources in supporting community health workers' home visits to enhance blood pressure control has been demonstrated. The connection between system supports and community resources is crucial for maintaining large-scale models that improve blood pressure control, especially among immigrants and individuals from underrepresented races and ethnicities who have multiple comorbidities [31-35].

To summarize, community-based models have enhanced access and incorporated specialized services into care delivered in greater proximity to individuals' residences. Research has shown that coordinated care, integrated clinician communication, and individualized health services may lead to better

management of blood pressure and fewer needless referrals. These interventions are designed to target the specific needs and objectives of patients. While patients have seen advantages from receiving treatment in their local communities, further research is required to determine the specific community resources and clinician skill sets that are necessary or need to be created as the complexity of cardiovascular care rises.

Models of care for cardiac and stroke rehabilitation

Rehabilitation programs are an established model of secondary preventive care and considered to be essential for comprehensive treatment to improve physical performance, emotional function, and self-care outcomes for patients with various CVDs, including stroke [36]. Traditionally, these programs have been hospital based, providing multifaceted interventions such supervised exercise training, nutrition guidance, self-care education, and assistance with lifestyle modification [37]. Improvements in functional capacity, quality of life, risk factor reduction, and death have been reported, although concerns persist about underuse and reimbursement [38]. Strategies such as inpatient education, appointment scheduling before hospital discharge, and reductions in out-of-pocket expenses were implemented to increase referral and enrollment. Access was enhanced by the implementation of more flexible appointment scheduling and the introduction of home-based participation alternatives [39].

The review provided inconsistent descriptions of program settings, components, and staffing patterns. It highlighted the emergence of community-based shared-care cardiac rehabilitation (CR) models led by general practitioners (GPs) as an alternative to traditional center-based programs led by cardiologists and nurses. While rates of program engagement seemed similar, participants in center-based programs showed higher adherence to dietary and lifestyle modifications compared to those in community-based, shared-care CR programs [40]. The extent to which these positive health outcomes depended on the resources available in different settings remains unclear.

Home-based cardiac rehabilitation (CR) programs have shown similar outcomes to traditional center-based programs, making them a safe alternative for patients in good health [41-44]. These programs help improve patient engagement and achieve comparable functional status outcomes. Additionally, the evolving stroke literature supports the use of rehabilitation programs in the community and at home, rather than in post-acute care facilities [45-50]. As a result of improved processes, patients now have increased access and engagement in appointments and goal setting. Stroke patients had enhanced physical performance, emotional functioning, and self-care outcomes due to their engagement in rehabilitation programs [51].

Research on more recent rehabilitation models has shown the advantages of technology-based approaches. Bellomo and colleagues [52] found that telerehabilitative treatment using interactive games for patients with chronic stroke resulted in comparable enhancements in functional status, namely in balance, motor and sensory function, and activities of daily living. Novel technology has proven to be effective in improving traditional cardiac

rehabilitation (CR). Randomized trials utilizing smartphone-based CR and avatars on social media platforms have shown enhancements in physical functioning. These improvements have been observed across different delivery methods and care settings. Stroke and CR programs have been linked to increased knowledge, reduced lipid levels, and improved medication adherence during follow-up periods of up to 12 months.

To summarize, rehabilitation programs for individuals after cardiovascular events frequently showed improvements in physical functioning. Research has consistently shown the need of relocating healthcare facilities in order to maximize efficiency by placing them in closer proximity to patients' residences. Generally, studies that lasted less than 12 months had inconsistent and challenging-to-determine results regarding changes in risk factor profiles and quality-of-life outcomes. Policy improvements shown potential in enhancing patient accessibility to rehabilitation services [53-55]. Future research should focus on identifying obstacles to access, determining the fundamental elements of rehabilitation therapy, and determining the necessary time to achieve different patient health outcomes.

Models led by nurses

Care delivery models led by advanced practice nurses aim to enhance patients' ability to take care of themselves and ensure that resources are available to support them in independently managing their care plan. This often involves coordinating with multiple healthcare team members, community resources, and family caregivers between health encounters. Advanced practice nurses also play a crucial role in facilitating communication and promoting long-term adherence to guideline-directed medical therapy. However, studies comparing different types of clinicians, such as physicians and advanced practice nurses, have yielded inconsistent results regarding the additional benefits to patients. Albert et al. [56] discovered that practices that had two or more advanced practice providers (APPs) were more inclined to use guideline-directed implantable cardioverter defibrillator/cardiac resynchronization therapy defibrillator (odds ratio, 1.99; $P<0.0001$) and provide heart failure education (OR, 1.91; $P=0.01$) compared to practices that did not have APPs. Virani et al150 found that APPs were more inclined than cardiologists to offer smoking cessation counseling (relative risk, 1.14) and refer patients to CR (relative risk, 1.4). However, there were no disparities between APPs and physicians in the other 9 performance improvement measures. Virani et al. [57] also showed that primary care Advanced Practice Providers (APPs) and doctors had varied levels of success in reaching outcomes of Guideline-Directed Medical Therapy (GDMT) for diabetes and cardiovascular disease (CVD). Within the primary care context, Advanced Practice Providers (APPs) had a higher likelihood of achieving glycemic control and sufficient blood pressure management. In contrast, doctors were more likely to achieve lipid control and administer β-blockers after a myocardial infarction.

Maciejewski and colleagues [58] showcased the enduring efficacy of a paradigm where nurses took charge of a comprehensive intervention including both behavioral and pharmacological management. This intervention successfully improved blood pressure levels over a span of 18 months, without any notable

rise in the use of services or expenses. Nurse-led programs have been shown to have similar advantages in managing medication and controlling risk factors to prevent stroke. In patients with atrial fibrillation, nurse-led care was found to be more effective than care provided by a cardiologist in terms of the combined primary outcome of cardiovascular death or hospitalization (14.3% versus 20.8%; hazard ratio, 0.65). However, there were no differences in the secondary outcomes of quality-adjusted life-years and cost. The main components of this nurse-led model included a specialized nurse who was responsible for education, self-care management, and coordinating care in collaboration with a cardiologist.

To summarize, nurse-led models have shown their effectiveness in patients with chronic cardiovascular diseases that need extended periods of follow-up. Nursing treatments centered on individual preferences and objectives, as well as the social and behavioral elements that influence the incorporation of the prescribed care plan into everyday routines. These models enhanced results pertaining to adherence, self-care, and mortality. Furthermore, there were also reports of decreased use of health services and a decrease in overall mortality.

Models led by pharmacists

Pharmacists were regarded as an essential element of multidisciplinary teams and integrated care models established and supported by various national societies and organizations. Their role encompassed a wide range of responsibilities, including providing consultation at the facility level, optimizing patient-specific pharmacotherapy, conducting medication reconciliation, and reducing errors. To address the absence of reimbursement mechanisms for services, health systems established medication management services or collaborative practice agreements to formalize the practice relationships and authorize pharmacists to prescribe medication.

Accumulated data from randomized controlled trials (RCTs) and observational research consistently shows that clinical pharmacists enhance outcomes in cardiovascular patients. Out of the studies included in this review, 5 were randomized controlled trials (RCTs) [59-63] and 6 were observational studies [35,37,38,45,55,56]. The cardiovascular populations that were assessed generally consisted of individuals with heart failure (HF), both with decreased and maintained ejection fraction characteristics, and with an average age over 55 years. Included in the study were patients with a diverse array of cardiovascular problems.

Pharmacists fulfilled many roles, such as being integral part of the cardiology team inside a hospital, practicing independently in direct patient care, providing consultation to the wider health system's team, or operating as distinct entities in the community. Across several studies, pharmacists' particular clinical responsibilities in direct care were comparable. However, there was substantial diversity in the techniques used to give care, including distinct clinical treatments and varying frequency of patient involvement, ranging from every few days to every few months. Studies that utilized a clinical pharmacist in their models showed enhancements in medication adherence and utilization of GDMT. However, the effects on hospitalization and mortality were not consistently

observed [35,46,48,52,59]. Decreases in medication errors were linked to shorter hospital stays, leading to cost savings for both patients and the healthcare system, especially in the field of anticoagulation management [47].

To summarize, pharmacist-led approaches prioritize the implementation of guideline-directed medical therapy (GDMT). These models played a crucial role in enhancing pharmaceutical safety by facilitating medication reconciliation, encouraging medication adherence, optimizing dosage, and reducing polypharmacy. Significant financial savings and decreases in the use of healthcare services were achieved as a consequence.

Summary

This study focuses on the existing care approaches for patients with cardiovascular problems in the postacute environment. The models were chosen based on their explicit use of evidence-based recommendations, clinical decision support tools, systematic assessment procedures, and incorporation of the patient's viewpoint in formulating the treatment plan. We observed significant diversity among the existing models, with a substantial number of more recent models being introduced in proximity to patients' residences in order to enhance accessibility. The staffing for these care models has progressively included multidisciplinary teams, while the precise duties and actions carried out by team members were not well defined. Researchers used several research designs to evaluate the efficacy of models in tackling different patient and health system outcomes. Despite the difficulties in making comparisons and establishing a definitive best practice, this study offers guidance for future research.

The future need for cardiovascular care necessitates the meticulous development and assessment of care delivery models, together with legislative solutions that efficiently encourage patient-centered methods. The existing notion of value-based care has to be broadened to include individual, systemic, and societal viewpoints. It is necessary to create performance measurements that accurately represent the outcomes that prioritize the individual's needs and are connected to well-defined care procedures. By addressing these methodological elements, it will be possible to make accurate comparisons that may provide guidance for the creation of future practice advances. The purpose is not to dictate uniform treatment procedures, but rather to provide significant comparisons, particularly about the metrics that are most important to patients.

The efficient use of interprofessional cooperation and diverse disciplinary perspectives in care delivery will become more important as clinical situations become more complicated, especially for those who are underprivileged and suffering with chronic, multimorbid cardiovascular illnesses. In order to improve access to effective treatment, it is crucial to comprehend the many aspects that define care delivery. This knowledge will enable patients to obtain the appropriate care from the correct physicians, at the right time and in the right location.

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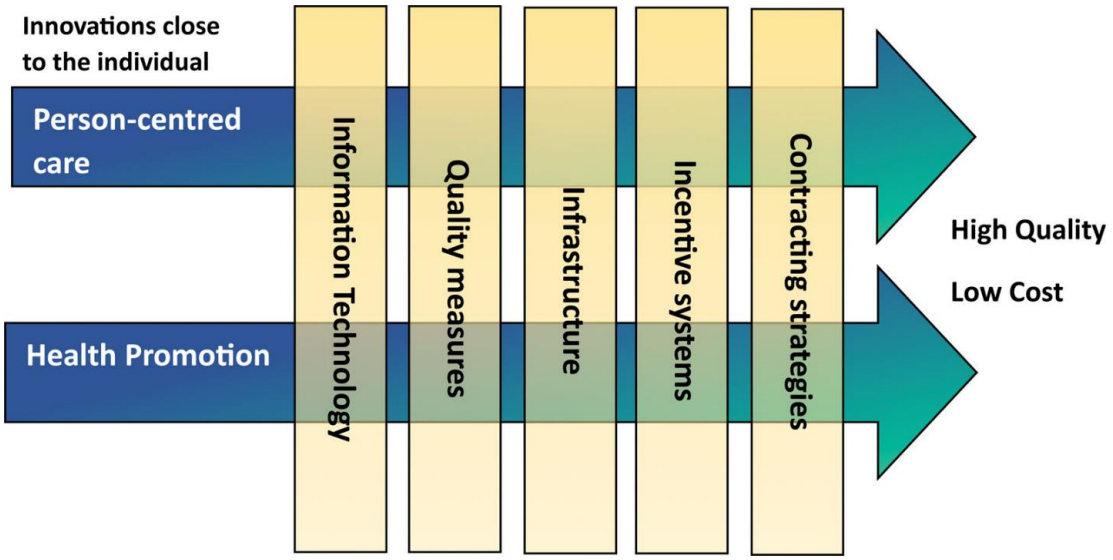

Figure 1. The assessment framework for the person-centered model of care is based on seven elements that have been recognized as crucial for guiding future healthcare.

الابتكارات في تشخيص أمراض القلب والأوعية الدموية غير الجراحية: التفاعل بين التمريض والصيدلة والسجلات الصحية والرعاية الطارئة في أمراض القلب

الملخص

الخلفية :تظل أمراض القلب والأوعية الدموية السبب الرئيسي للوفاة والعجز في الولايات المتحدة وعلى مستوى العالم. على الرغم من التقدم التكنولوجي الذي عزز من متوسط العمر المتوقع وجودة الحياة، إلا أن انتشار الأمراض القلبية يستمر في الزيادة، وغالبًا ما يرتبط بزيادة عدد السكان المسنين الذين يعانون من حالات مزمنة متعددة. غالبًا ما تتجاهل الإرشادات السريرية الحالية تعقيد الأمراض المتعددة والتعقيدات المرتبطة بأنظمة الرعاية الصحية، مما يجعل تنفيذها العملي تحديًا. علاوة على ذلك، فإن خطط الرعاية غالبًا ما تفشل في مراعاة التفضيلات الثقافية والاجتماعية وأنماط الحياة التي تشكل السياق الاجتماعي والبيئي للفرد، مما يعيق القبول والفعالية، خاصة بين الفئات السكانية ذات المخاطر العالية.

الهدف :الهدف من هذا البيان العلمي هو تقديم نظرة شاملة على نماذج تقديم الرعاية الموجهة للشخص لاضطرابات القلب والأوعية الدموية المحددة، مع التأكيد على الخصائص والنتائج الموثقة لهذه المناهج.

الطرق :تم إجراء دراسة مسحية باستخدام بحث منهجي في قواعد البيانات بما في ذلك Ovid MEDLINE و Embase.comو Web of Scienceو CINAHL Completeو Cochrane Central Register of Controlled Trialsعبر Ovid وClinicalTrials.gov، تغطي الفترة من 2010 إلى 2017. تم تضمين تصاميم البحث المتنوعة التي تقيّم بشكل محدد طرق تقديم الرعاية لأمراض القلب والأوعية الدموية المستهدفة. تم اختيار النماذج استنادًا إلى إدماجها للتوصيات المستندة إلى الأدلة، وأدوات الدعم في اتخاذ القرارات السريرية، وإجراءات التقييم المنظم، ووجهة نظر المرضى في تشكيل خطط العلاج.

النتائج :كشف البحث عن اختلافات كبيرة في الأساليب ومقاييس النتائج وممارسات الرعاية عبر النماذج المختلفة التي تم فحصها. ومع ذلك، كان هناك نقص ملحوظ في الأدلة الشاملة التي تدعم أنجح نماذج تقديم العلاج، ويرجع ذلك إلى عدم التناسق في المناهج، والتباينات في هياكل الدفع، وصعوبة النظام الصحي في تلبية الاحتياجات المعقدة للمرضى الذين يعانون من أمراض القلب والأوعية الدموية المزمنة.

الخاتمة :هناك حاجة ملحة لتطوير وتنفيذ نماذج تقديم الرعاية الموجهة للشخص التي تدمج بشكل فعّال الممارسات المستندة إلى الأدلة وتراعي الاحتياجات والتفضيلات الفردية للمرضى. يعتبر معالجة هذه العناصر أمرًا حيويًا لتحسين النتائج وقبول خطط العلاج، لا سيما في الفئات السكانية ذات المخاطر العالية لأمراض القلب والأوعية الدموية.