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Heart failure disease management program
A review

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Abstract

Disease management programs (DMPs) have shown great potential for optimizing care of chronically ill patients, thereby improving health outcomes and patient satisfaction. This had led to an overall reduction in healthcare costs. Longer life expectancy has led to increased utilization of healthcare facilities, which may lead to a rise in costs. DMPs are an effective means of improving care and compliance and ultimately curbing inappropriate resource utilization. The present study reviews different definitions proposed for disease management, its components, the evidence behind it, and the conditions for success. It also examines heart failure management as an example of a DMP, exploring the complexity surrounding implementation of guideline-based approaches in patient care. A literature search on DMPs was conducted using PubMed, MEDLINE, and Google Scholar, including heart failure management programs from articles published from 2000 to 2020. This reviewed emphasized on the management of important biomarkers and cardiovascular indicators such as glycemic levels, urine output to improve efficacy of disease management programme during patient treatment.

The review concluded that diseases like heart failure can be combat by improving the quality of care for patients and reducing the burden on the public healthcare system. Moreover, DMPs have proved to be an effective way of improving care and compliance with treatment.

Abbreviations: AHA = American Heart Association, DMAA = Disease Management Association of America, DMPs = Disease Management Programs, ECG = Electrocardiogram, HF = Heart Failure, HFeEF = Heart failure with reduced ejection fraction, HFpEF = Heart failure with preserved ejection fraction, HFSA = Heart Failure Society of America, USD = United States Dollar.

Keywords: Chronic, compliance, cost-effectiveness, disease management program, heart failure

1. Introduction

Over the past decade, the rising incidence of chronic diseases and disjointed nature of care available for patients suffering from this disease worldwide has led to a steep increase in healthcare costs,[1]accentuate the need for a more integrated approach to care for the chronically ill patient. Many organizations and governments are embracing disease management to restructure medical treatment for chronic illness. Disease management has demonstrated great potential as a means of improving health outcomes for chronically ill patients, leading to increased patient satisfaction and decrease in healthcare costs.[2] However, the heterogeneous nature of the definition of disease management and widespread application of disease management programs (DMPs) has hindered their implementation and applicability.

Although "disease management" is a common term, it has multiple definitions and various models, which often causes confusion. Risk management and coordination of care form the basis of DMPs; however, individual program components can vary, making it difficult to develop a universal definition. The difficulty increases further because of complexities in the origin and historical evolution of disease management.[3]

The term "disease management" dates back to 1996 and different elements of DMPs have been used historically throughout medical practice.[4] For instance, managed care organizations were the first ones to adopt the concepts of disease management.[5] This is because hospital costs comprise a substantial proportion of patients' healthcare resource utilization, which means that managed care organizations were financially motivated to reduce hospitalization rates and length of stay. Conversely, disease management strategies adopted by pharmaceutical companies included ancillary services provided to patients with chronic illnesses. Such services included educational and awareness programs to increase medication adherence and compliance. Moreover, these programs increased revenue for pharmaceutical companies and increased the prospect of pharmaceutical products added to health maintenance organization formularies.[6]

The mid-1990s observed widespread adoption of disease management strategies by the healthcare industry to control

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costs. An increase in medical literature assessing disease management was also observed during this period.[3] The concept of disease management was further substantiated by results from a prospective, randomized trial that assessed the benefits of disease management for HF on hospitalization and readmission rates, quality of life, and cost of medical care by engaging nurses in providing care for elderly patients (>70 years of age) with HF.[7] The study reported a 56% reduction in the rate of readmissions for HF and a savings of 500 USD for each patient enrolled. It also demonstrated that a multidisciplinary intervention strategy can considerably improve the quality of life for elderly patients with HF.[7]

Therefore, the present study reviews different definitions proposed for disease management, its components, the evidence behind them, and the conditions for success. The study also focuses on the management of heart failure (HF) as an example of a DMP.

2. Search strategy

The focused literature search for this narrative review was perfumed using PubMed, MEDLINE and Google Scholar to scrutinize relevant articles. The search terms including "Heart Failure Disease Management Program," "Interventions for Heart Failure," "Management of Heart Failure," "Therapeutic approaches for Heart failure management," and "Recent heart failure management approaches" were used for articles' selection. The literature search included published clinical and translational studies and articles relevant to appropriate disease management in Heart Failure and excluding articles emphasizing on regular laboratory examinations. In addition to this, most recent disease management guidelines from "American Heart Association – AHA/ American College of Cardiology – ACC" and "European Society of Cardiology – ESC" were also studied for inclusion in review.

3. Inclusion and exclusion criteria

The relevant articles were reviewed and short listed by 2 individual researchers (A) and (B), whose identity was kept confidential to avoid biasness. The individual researchers, after review of relevant abstracts and full articles were obtained for relevant research papers and articles. The exclusion criteria included all other languages except English, animal studies and articles without full text. This study included adult population underwent hospital admission due to heat stroke or heat exhaustion. In this review, considering the application domain including disease management program

4. Results and discussions

Totally 17,800 citations were identified through electronic searches. Titles and abstracts were screened for relevance (stage 1 screening), and then study duplications were identified, resulting in 210 relevant citations being retained. The full texts of these articles were obtained. Then applying inclusion criteria to these full-text articles (stage 2 selection), 187 citations were excluded, which were not according to inclusion criteria. Twenty-three citations were therefore included in this review.

A review of the published literature on 18 trials for disease management interventions reported a 25% reduction in the risk of readmissions over a mean observation period of 8 months.[8] By 1999, approximately 200 DMPs had been established for disease conditions such as congestive HF, diabetes, and asthma.[9] Integrated patient care, patient education, and gathering outcomes data formed the core characteristics of these disease-specific programs. Development of proprietary treatment algorithms and unique component packages in response to market pressures resulted in diverse and varied private-sector DMPs.[3]

There are disease-specific elements including the outcomes, testing procedures, and treatment; although the core characteristics of DMPs are similar. For instance, it is essential to conduct regular eye examinations for diabetes disease management,[10] similar to taking peak expiratory flow measurements to underpin the management of asthma.[11] This highlights the importance of developing an individualized HF DMP. Furthermore, DMPs can also vary by country, due to different healthcare systems and policies implemented within each region. For example, some countries may have a more nurse-led approach to coordinating chronic disease management; while, other countries have implemented a population-specific DMP to focus on the elderly population.[12] Furthermore, there are major differences in reimbursement, services, and coordinators involved in chronic disease management and interventions.[13]

4.1. Selected disease management definitions

Disease management has been described as involving the use of comprehensive and systematic population-based approaches to enable the identification of at-risk individuals, initiation of specific programs of care, and the assessment of outcomes.[4] Disease management has also been defined as an integrated approach to patient care that reflects the natural course of disease to combat each condition effectively and efficiently in different treatment settings.[14] Furthermore, disease management is commonly described as a multidisciplinary effort to ameliorate quality of care and cost-effectiveness for individuals suffering from chronic disease and include interventions to increase the likelihood of following clinical guidelines.[15]

The Disease Management Association of America (DMAA) defines disease management as "a system of coordinated healthcare interventions and communications for populations with conditions in which patient self-care efforts are significant."[16,17] According to this definition, disease management enhances physician-patient relationships and care plans, uses clinical guidelines and patient education to reduce the chance of exacerbations or complications. It also measures a number of outcomes to ameliorate the overall health of the patient.[3]

Many programs do not meet the standards of the DMAA's definition for disease management and those are described as DMPs in the medical literature.[18] The challenge in agreeing to a standard definition arises due to multiple care management models being presented for disease management. Various models have arisen because DMPs have traditionally focused on multiple health problems to provide integrated patient care and encompass varying patient comorbidities. At times, the term "disease management" has been replaced with terms such as "case management," "coordinated care," and "multidisciplinary care" without clearly definition of the individual characteristics of each term.

4.2. Disease management components

A DMP includes 6 components:

- population identification process
- evidence-based practice guidelines
- collaborative practice models
- patient self-management education
- process and outcome management
- Reporting and feedback loop.

These components are included in several domains proposed by the American Heart Association's (AHA) conceptual

model.[3] DMPs that include fewer than 6 components are deemed to be disease management support services, rather than full programs.[3] Regarding the disease management, the American Heart Association's expert panel recommended that improvement in patient quality of care and outcomes should be the primary focus of disease management.[15] The basis of all DMPs should be scientifically derived, peer-reviewed guidelines that are evidence based and consensus driven, resulting in increased adherence to treatment plans. Furthermore, the success of DMPs should be assessed by consensus-based measures. The results from scientifically based evaluations of clinical outcomes could be used to modify ongoing DMPs and improve the benefits to patients. Additionally, care should be taken to ensure that the DMPs support and augment the patient–provider relationship, which could lead to improvements in quality and coordination of care. Further, patients suffering from chronic diseases often suffer from multiple comorbidities, and strategies should be developed to address the challenges faced while caring for these patients.[15]

4.3. Heart failure management as a model

The implementation of guideline-based therapies is challenging, given the complexity of HF management. For instance, HF care is intensive as it requires close monitoring of patients by the clinicians, along with patient self-management. In addition, HF care is often further complicated by comorbid diseases, polypharmacy, and reduced functional and/or cognitive status.[19,20] Hospitalization for HF is distressing for the patient, their family, and a major burden on the healthcare system. Within 6 months of discharge, 25% to 50% of hospitalized HF patients are likely to be readmitted.[21,22]

The Heart Failure Society of America (HFSA) identified patients who may benefit from such programs, including those recently hospitalized for HF and other patients at high risk (i.e., those with renal insufficiency, low output state, diabetes, and chronic obstructive pulmonary disease). Patients suffering from multiple comorbidities or cognitive impairment, or those with persistent New York Heart Association class III or IV symptoms are also at high risk and should be included in HF management programs. Additionally, patients with a lack of social support and health literacy and persistently non-adherent to medication should also be included in HF management programs.[23]

The components of a HF management program have been recommended by the HFSA and include comprehensive education and counseling to fulfill the needs of individual patients. The program also promotes self-care, including self-adjustment of diuretic therapy either by the patient or with assistance from a family member or caregiver. Additionally, the HFSA recommended increasing adherence by employing behavioral strategies, vigilantly observing post-discharge follow up, optimizing medical therapy, increasing access to providers, and providing support for social and financial concerns.[23]

A crucial component for the success of a program is timely follow ups. Any issues that might arise must be dealt with preemptively. It is recommended that patients with higher risks should be followed up within 72 hours after discharge through telephone contact, home or clinic visit, or tele-monitoring. A follow-up visit should be scheduled within 7 to 10 days of a hospitalization or emergency department visit for HF. The caregiver or the patient should be provided with a clear plan of action in case there is a sudden or incomprehensible change in medical status.[23] A stable patient should be followed up with no later than 12 months and a return visit should be scheduled even sooner for patients with advanced HF. Moreover, telephone contact or the use of tele-monitoring devices should be considered, if available.[23]

4.4. Levels of management in heart failure programs

Several levels of integrated management programs have been reported for HF[24]:

- The first level involves only structured telephone support with direct calls from clinician to patient, has been shown to reduce HF hospitalizations but not all-cause hospitalizations or mortality.[25,26]
- The second level emphasizes long-term patient self-care activities with frequent reinforcement and has been shown to reduce HF hospitalizations and all-cause hospitalizations, but had no significant effect on mortality.[27,28]
- At the highest level are strategies that incorporate an in-person specialized multidisciplinary follow-up either at home or at the clinic. These reduce HF hospitalizations, all-cause hospitalizations, and mortality.[29]

4.5. Costeffectiveness

Increased use of healthcare services, such as physician visits and prescription drugs have been observed in people with chronic diseases.[30] Also, a rise in people suffering from chronic conditions coupled with increased longevity will inevitably increase healthcare expenditures that prompt the need for solutions to reduce healthcare costs and use. One such solution is disease management, which aims to improve care by reducing the costs associated with caring for the chronically ill.[31] The available research detailing the impact of DMPs on cost, quality of care, and health outcomes is not conclusive. For example, mixed results were observed for programs that were designed to implement widespread, evidence-based guidelines for the care of patients with HF.[25,27] A reduction of 5% to 25% in hospitalization rates and post-discharge mortality for HF was observed for some DMPs, while others failed to show positive impacts on post-hospital mortality. Similarly, some DMPs saved enough to cover program costs by reducing hospitalizations.[7] Previous studies showed mix results for DMPs for chronic conditions, including heart disease, diabetes, and asthma.[32–34] Some programs led to savings of 6.50 USD for every dollar invested by the payers, while others did not generate any savings. Some non-randomized studies reported the effect of intervention in heart failure clinic in intervention and control group with follow-up of 6 to 12 months (Table 1).[35–41]

Gregory et al[42] reported the economic effect of a tertiary HF program, conducted from 2000 to 2001, including 82 patients with HF who underwent complete transplant evaluations. It is important to note that not all patients who formally presented to the institution's Cardiac Transplant Committee were listed for transplantation after the committee's final recommendation. This division facilitated the comparison of economic contributions between patients that underwent transplantation and those who did not.[42] The patients, who underwent transplantation, had a mean hospitalization rate of 2.1, whereas mean hospitalization rate for non-transplant patients at the end of the first year of follow-up was 1.1. The outpatient encounters were 11.9 and 6.0 per patient for transplant and non-transplant patients, respectively at the end of the first year of follow-up.[42] In addition, the mean direct cost per patient was 146,623 USD for transplant patients versus 33,424 USD for non-transplant patients. This shows improvement in the savings with substantial quality of care and survival of patients.[42] The study concluded that hospitals might augment quality of care and attract additional patients by implementing high-quality HF programs that address the multidisciplinary needs of the HF patient population. This would lead not only to enhance economic benefits for hospitals, but may also help optimize the medical needs and care of HF patients.[42] Improvement in

Table 1

Effect of intervention in a heart failure clinic: results of non-randomized studies.

Author, year	N (Intervention/ Control group)	Intervention	Follow-up (months)	Results (intervention vs usual care)
Akosah, 2002[35]	38/63	Team management, medical optimization, education	12	Lower combined endpoint hospitalization/mortality. Higher doses of ACE-inhibitors and b-blockers
Azevedo, 2002[36]	157/182	Physician directed clinic, medical optimization	12	Lower mortality, fewer hospitalizations
Galatius, 2002[37]	283/NA	Team management, medical optimization, education	12	Fewer hospitalization
Holst, 2001[38]	42/NA	Team management. Medical optimization, education	6	Fewer hospitalizations, improved functional capacity, QOL improved
Ramahi, 2000[39]	133/NA	Team management, medical optimization, education	12	Higher rates of appropriate drugs use. Improved functional status
Riegel, 2000[40]	120/120	Nurse education, home visits, dietician, pharmacist counseling	6	No overall effect on hospitalization. Hospitalizations reduced in function class II patients
Whellan, 2001[41]	117/NA	Team management Medical optimization, education	10	Fewer hospitalizations, higher rate of b-blocker use

Randomized trials evaluating the effect of disease management programs on hospital readmission of older patients with heart failure shown in Table 2.[42–53]

self-care practices and reduction in hospital readmissions, emergency visits, and use of healthcare services through different DMPs have resulted in reduced healthcare expenditures for some patient populations with chronic diseases.[31]

4.6. Conditions for successful implementation of DMPs

Implementation or replication of DMPs has been difficult because different programs have focused on different populations and interventions. Additionally, studies focused on DMPs have used varying criteria and measures to estimate the efficacy of the program, which makes it difficult to draw conclusions about the effectiveness of DMPs. The US National Committee for Quality Assurance has developed standards for reporting the effectiveness of DMPs that are even included in its accreditation process.[34]

Most DMPs described in the literature recruited patients during hospital admission for HF; however, these programs generally involved care after discharge.[43] Although, HF patients have high rates of recurrent admissions, there is reduction in readmission rates following implementation of DMPs after discharge, as many as 15% of actively treated patients are readmitted or dies within 15 to 30 days post-discharge. This has become a major critique of programs that only focus on the outpatient phase and points toward the need for more structured inpatient care.[43]

Systematic reviews based on studies of different DMPs have highlighted that a comparison of the individual components is lacking, which means that the ideal combination of individual DMP components has not yet been elucidated. The programs examined are heterogeneous, focusing on different interventions, strategies, providers, and patients.[44] A DMP is appropriate when practices vary and there are poor outcomes due to lack of evidence for intervention effectiveness and difficulties with continuation of care. The availability of evidence should be considered a definitive criterion for successful implementation of a DMP to facilitate acceptance of the program and assessment of its impact.[44]

Disease management necessitates behavioral changes in care providers and patients, which could be achieved through education and training programs, timely feedback, and reminders directed at providers and patients. For example, the program should target the modification of patient behavior, if patient compliance and medication adherence are crucial for achieving positive outcomes. Furthermore, programs should focus on achieving an effective balance between quality of care, provider and patient satisfaction, and cost for enhanced DMP adherence. Continuous improvement in the quality of care is essential for the success of DMPs through the provider's adherence to standard of care and the patient's ability to monitor their disease. A system of indicators to measure intervention performance and outcomes could be one of the strategies for ensuring sustainability of results.[44]Some studies emphasizing on the management of important indicators to prevent Heart Failure and manage patients prophylactically are mentioned in Table 3.

4.7. Quality of life with DMPs

DMPs have resulted in some improvement in quality of life for chronically ill patients. However, quality of life is subjective because it is affected by the patient's confidence in their health and their ability to monitor and control their condition.[31] Improvement in quality of life was observed in a group of people aged ≥70 years in a chronic HF program, compared with people who were not in the program. Within the first few months, people enrolled in the program reported less fatigue, improved emotional state, and increased control over their condition.[7]

Table 2

Randomized trials evaluating the effect of disease management programs on hospital readmission of older patients with heart failure.

Author, Year	O/F	Main findings: intervention vs usual care[c]
DIAL, 2003[42,43]	A,B,C (1.2 years)	SI produced a 20% relative risk reduction on the combined end-point (HF hospital readmission or death, 26.3% vs 31%, P ¼ 0:02). SI decreased the number of patients with HF hospital readmission.
Laramee, 2003[44]	A,B (3 months)	readmission rates were equal for both groups (37%). Total inpatient and outpatient median costs and readmission median cost were reduced 14% and 26%, respectively, for the SI group. Subgroup analysis of patients who lived locally and saw a cardiologist showed a significant decrease in HF readmissions for the SI group.
Stromberg, 2003[45]	B,C (3 & 2 month)	There were fewer patients with the combined end-point (readmission or death) after 12 months in the SI group compared to the control group. The SI group had fewer re-admissions (33 vs 56, P ¼0.047) and days in hospital (350 vs 592, P ¼ 0:045) during the first 3 months. After 12 months the SI was associated with a 55% decrease in admissions/patient/ month and fewer days in hospital/ patient/month.
Doughty, 2002[46]	A,B,C (1 year)	SI reduced total hospital readmissions and total bed days. The main effect of the intervention was attributable to the prevention of multiple re-admissions. SI improved quality of life
Harrison, 2002[47]	B (3 months)	In the SI group the percentage of patients readmitted was 23 vs 31 in the US group, 35 patients did not complete the study to 3 months.
Kasper, 2002[48]	A, B, C (6 months)	SI reduced the Combined endpoint (HF hospital readmission or death: 43 re-admissions and 7 deaths vs 59 and 13, The quality-of-life score, percentage of patients on target vasodilator therapy and percentage of patients Compliant with diet recommendations were significantly better in the SI group.
Krumholz, 2002[49]	A, B, C (1 year)	SI reduced the Combined endpoint (hospital readmission or death 25 vs 36. SI obtained a 39% decrease in the total number of readmissions. After adjusting for clinical and demographic characteristics, the SI group had a significantly lower risk of readmission.
McDonald, 2002[50]	A, C (3 months)	SI reduced the combined end-point (HF hospital readmission or HF death. HF readmission was far less frequent in the SI group (25.5% vs 3.9%)
Riegel, 2002[51]	A,B (3 & 6 months)	The HF hospitalization rate was 47.5% lower in the intervention group at 3 months and 47.8% lower at 6 months. HF hospital days were significantly lower in the intervention group at 6 months. A cost saving was realized even after intervention costs were deducted. There was no evidence of cost shifting to the outpatient setting. Patient satisfaction with care was higher in the intervention group
Stewart, 2002[52]	B,C (4.2 years)	There were significantly fewer unplanned readmissions and fewer combined end-points (unplanned readmission or death): a mean of 0.21 vs 0.37 events per patient per month. Mean event-free survival was more prolonged (7 vs 3 months). Assignment to intervention was both and independent predictor of event-free survival.
Blue, 2001[53]	A,B,C (1 year)	SI reduced the combined end-point (HF hospital admission or death. There were fewer readmissions for any reason (86 vs 114, P ¼ 0:018), fewer admissions for HF (19 vs 45, $P < 0.001$), and fewer days in hospital for HF (mean 3.43 vs 7.46 days)

Table 3

Some studies emphasizing on the management of important indicators to prevent HF.

Author	Year of Publication	Causative Factor	Disease Management Approaches for HF
Chow et al[57]	2017	Biomarkers presence (galectin-3, natriutic peptides, sensitive troponins, cyctatin-C, tumorgenicity 2 soluble suppressor, interleukin 6)	Measurement of biomarkers concentration as noninvasive management approach aid determining and monitoring disease severity. Including monitoring of novel biomarkers such as "HFpEF and HFeEF" ON ECG to monitor diastolic dysfunctioning.
Konstam et al[58]	2018	Hypoxia and Chronic lung diseases, chronic thromboembolic activity, pulmonary arterial hypertension	The management of acute right heart failure involves volume management at initial stages to reduce left atrial pressure and pulsatile RV loading and congestion. Stepped pharmacological care include urine output (UO) > 5L/d to decline active diuretic regimen (from randomization to 96hours daily), UO3-4 L/d to continue active diuretic regimen and UO <3 L/d to monitor diuretic grid with 24 hour UO assessment.
Dunlay et al[59]	2019	Type 2 Diabetes Mellitus	the risk of nonfatal myocardial infarction (MI) can be reduced with control of glycemic levels, use of medication agents including biguanides, sulfonylureas, insulin, GLP-1 (glucagon-like peptide-1) receptor agonists and thiazolidinedione's
Rossignol et al[60]	2019	Smoking, excessive alcohol consumption, sedentary lifestyle, and obesity	Use of telemedicine programs to remotely evaluate patient condition with the aid of multi-disciplinary teams. ICALOR programme implementation, optimization of symptom-alleviating and life- saving HFrEF 377 pharmacological treatments
Healy et al[61]	2019	Lifestyle patterns	More recent approach for DMPs included monitoring of patients with HF-PEF, stable patients and attention on requirement only to be given to the "well HF patient" to ensure optimal care is put in place at that stage reducing the chances of disease progression. A central aspect of DMPs should include identifying these patients at risk and preventing the natural decline of disease to the point of admission to hospital which is seen as a critical time point of the disease.

4.8. Commitment and compliance

Patients and providers might be expected to invest substantial time and effort to improve their healthcare practices as part of a DMP. One important challenge in disease management is patient compliance. Variations in compliance may be due to patients who do not fully trust the program or those who are set in their ways and try to avoid the changes implemented by the DMPs.

Patients and providers can be encouraged to enroll in a program by communicating the benefits of DMPs and providing financial incentives. Some programs even offer added benefits in the form of reduced co-payments and discount coupons for disease-specific medical supplies.[31] Some providers might be concerned with reduced revenue due to decreased use of healthcare services. Financial incentives could motivate providers in terms of DMP participation and compliance, but incentives should be given only for activities that have evidence of effectiveness. However, few health plans provide extra payments to providers for their involvement in DMPs.[31]

Communication barriers and cultural differences pose another challenge to DMP commitment and compliance. It is essential to contact each other through e-mail and telemonitoring, whenever feasible for the providers and patients. Moreover, providers that are part of coordinated care systems should communicate effectively with each other to facilitate sharing of the patient's health status and case notes, which will subsequently benefit the patients.[31]

4.9. Considerations for policymakers

Based on the Patient Protection and Affordable Care Act (P.L. 111-148) passed in March 2010, policymakers are required to consider the following recommendations;[34]

- While developing models to improve the efficiency and quality of care, health initiatives should aim to establish care coordination for individuals at high risk for hospitalization.
- Increased funding is needed to develop primary care-centered medical facilities for patients with chronic conditions.
- Community-based, interdisciplinary professional teams need to be engaged to support primary care practices; while, effective systems are established to manage a range of healthcare problems in both children and adults
- Health plans should publicly report chronic disease management as a quality of care indicator.

5. Conclusions

It is predicted that the incidence of HF is likely to rise as the population continues to age and survival among patients with heart disease improves. However, it is essential to manage HF patients in a systematic and integrated manner to combat such diseases by improving the quality of care for patients and reducing the burden on the public healthcare system. DMPs offer an effective means of improving care and compliance with treatment. Proper adherence to such programs will reduce hospital readmissions and slow down the disease progression. There are some limitations to the development of HF DMPs, including the intensity of HF care, which requires close monitoring in addition to patient self-management. Furthermore, HF may be complicated by comorbidities or polypharmacy as well as the impaired cognitive and functional status of the patient. Management of HF patients also involves timely follow-up and multiple layers of support. This study has a limitation that it does not cater the data related to cost-effectiveness involved in the designing and management of heart failure DMP programs.

Improved management of chronic conditions is linked to better health outcomes for the patient. However, there is no conclusive evidence on improvement of the survival rate or quality of life through DMPs. However, more data are required on the cost-effectiveness of such DMPs to enable their implementation on a larger scale. Moreover, additional research is needed for assessing long-term cost savings and performance of DMP interventions and outcomes.

Author contribution

The sole author is responsible for correspondence, analysis, drafting and all aspects of the research.

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