



Managing the performance of general practitioners and specialists referral networks: A system for evaluating the heart failure pathway



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ABSTRACT

High quality chronic disease management requires coordinated care across different healthcare settings, involving multidisciplinary teams of professionals, and performance evaluation systems able to measure this care. Inter-organizational performance should be measured considering the professional relationships between general practitioners (GPs) and specialists, who are usually linked through informal referral networks.

The aim of this paper is to identify and evaluate the performance of naturally occurring networks of GPs and hospital-based specialists providing care for congestive heart failure (CHF) patients in Tuscany, Italy. The analysis focuses on the identification and classification of networks, following CHF patients (n = 15,841) through primary care and inpatient care using administrative data, and on the assessment of process and outcome indicators for CHF patients in these referral networks.

We demonstrate the existence of informal links between GPs and hospitals based on patterns of patient flow. These networks which are not geographically based vary in the intensity of relationships and quality of care. Such referral networks may represent the most effective accountability level for chronic disease management, since they encompass the multiple care settings experienced by patients. Overall, an integrated approach to evaluation and performance management that considers the naturally occurring links between professionals working in different settings may enable more efficient, integrated care and quality improvements.

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1. Introduction

Chronic conditions are becoming increasingly important for health systems worldwide, and account for approximately 46 % of the global burden of disease [1]. The management of these conditions poses significant challenges for patients, health professionals, and health systems more broadly. Congestive heart failure (CHF) is a chronic disease with high prevalence [2], affecting tens of millions of patients worldwide. It frequently arises as a result of ischemic heart disease (IHD), the world's leading cause of death in 2010 [3]. The prevalence of CHF is expected to increase due to higher life expectancy and reductions in acute IHD mortality [2]. CHF is frequently diagnosed in hospitalized patients. The proper management of CHF involves both primary and specialist care, with co-management of patients to ensure the implementation of

evidence-based therapy, effective management of comorbidities, and timely follow-up [4,5].

Improving coordination of care for chronic disease patients reduces hospitalization rates, increases quality of life for patients and improves health system sustainability [6]. Multidisciplinary care teams are recommended in CHF guidelines, with the evidence demonstrating improved outcomes, alleviation of suffering, and better experience for patients and their families [7]. Additionally, CHF patients managed in a coordinated manner by primary care and specialist physicians have higher survival rates than those followed only by family physicians [8,9] as well as reduced hospital readmission rates [10].

However, primary care and inpatient settings typically operate in silos, where general practitioners (GPs) and specialists work in separate systems with poor communication, information and limited shared responsibility [11,12]. Indeed, performance evaluation systems (PES) in healthcare favor measures at the organizational level, by setting goals and monitoring performance results, stressing departments' productivity (e.g., volumes and complexity)

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[13,14] and creating competition for resource allocation. These PES limit the ability of healthcare stakeholders to assess performance through the perspective of care pathways [15] and according to the public value creation paradigm - which should be the reference paradigm of public healthcare systems [16]. Effective performance evaluation systems are therefore needed to monitor integrated care pathways to enhance system accountability, reduce unwarranted variation, and improve quality of care.

Accurately measuring the performance of care pathways requires a focus on inter-organizational networks that allow coordination between health professionals across organizational boundaries. These networks, which may or may not be officially constituted, should care for patients along all phases of the care pathway. The relationships among network providers are characterized by interdependence, complexity, and continuous change. These features, plus the absence of a clear hierarchy, makes their assessment problematic [17].

Inter-organizational performance can be measured by considering the professional relationships between GPs and specialists, who are usually linked through informal referral networks which could be based on the collective experience of working together. These informal links between GPs and hospital health professionals are described using patterns of patient flow which can be identified through linked administrative healthcare databases. We believe that these primary and hospital-based specialist care networks may represent an effective level of accountability for health system management. Indeed, making professionals accountable for patients they have in common [8] by measuring performance on their outcomes and on process indicators can enhance collaboration and integration across different care settings. Our work uses these multi-specialist care networks as units of performance measurement.

2. Measuring and evaluating integration of care using administrative data

Previous studies have identified informal multi-specialist care networks through the linkage of health administrative data. Bynum et al. [18] developed a methodology to assign U.S. Medicare patients and the ambulatory physicians who serve them to individual hospitals. Other work shows how administrative data can be used to understand how care is actually delivered and organized by groups of primary care doctors, and thus to measure how practitioners are interconnected through their care of patients [19]. Landon et al. (2012) applied social network analysis to U.S. Medicare data to define professional networks based on patient sharing among physicians, and also examined how such networks vary across geographic areas [20]. Stukel et al. (2013) identified informal multispecialty physician networks in Ontario (Canada), by linking GPs and specialists to the hospitals where most of their patients were admitted [21].

Building on the experience of Ontario, the present study aims at identifying naturally occurring links between primary care physicians and hospitals-based specialists involved in the management of CHF in Tuscany (Italy) using health administrative data. Additionally, the performance of each primary and specialist care network is evaluated through a set of evidence-based indicators for CHF care that include both process and outcome measures.

3. Context

Italy's health-care system is a regionally based National Health Service (NHS), which provides universal coverage largely free of charge at the point of delivery. Tuscany is a large region in central Italy, with a non-competitive health system providing prevention

and primary care as well as hospital services. The regional health system in Tuscany (TRHS) is responsible for the health of 3.7 million inhabitants (6.2% of the Italian population [22]) and comprises three local health authorities with about 40 community hospitals, four teaching hospitals, one mono-specialist cardiac centre, and 34 health districts. The local health authorities provide preventive medicine and public health services, primary care, and inpatient and outpatient care, while the teaching hospitals focus on acute care and professional training. Primary care physicians are funded on a capitation basis and their activity is coordinated with the services provided by the health district. In the TRHS, about 2,650 GPs provide family medicine services and act as gatekeepers to higher levels of care [23]. Multiple primary care physicians and specialist networks form across the TRHS, since GPs can refer patients to any specialist (inpatient and outpatient), and patients are free to seek care from any provider.

Recently, the TRHS developed a new form of primary care professional integration at the local level (territory) by adopting the Territorial Functional Aggregations (*Aggregazioni Funzionali e Territoriali* - AFTs). AFTs are compulsory networks of GPs expected to apply clinical governance principles to continuously improve the quality of services and safeguard high standards of care [24]. Currently 116 AFTs (2017) have been established throughout the TRHS. On average, each AFT serves a population of about 30,000 patients by 23 GPs [23]. Our research anticipates that these networks of GPs will show inter-network variability in outcomes and processes for the care of CHF patients.

4. Materials and methods

Adopting the methods of Stukel [21], the identification of primary and specialist care networks was based on a retrospective analysis using different sources of routinely collected health administrative data from the Tuscan region for 2014–2016. Specifically, the individual level health databases used in the present study include: (i) hospital inpatient data where data are coded using the 9th revision, ICD9-CM; (ii) emergency care data; (iii) registered persons database which includes data on all persons enrolled in the Tuscan health care system including date of birth, date of death, and assigned primary care physician. The different administrative databases were linked at individual (patient) level through a unique identifier. Additional administrative data were used to measure performance indicators, namely outpatient drug prescription data, using the Anatomical Therapeutic Chemical (ATC) classification system and outpatient care data.

Data were anonymized at the Regional Health Information System Office where each patient was assigned an encrypted unique identifier. The study was carried out in compliance with the Italian law on privacy, and approval by an Ethics Committee was not required.

The data management and the analyses were run using SAS version 9.4 (SAS Institute).

4.1. Cohort selection and primary and specialist care networks identification

The multispecialty physician networks for CHF care were identified using a two-step process: using health administrative data, a cohort of patients with cardiac conditions was selected and each patient assigned to his/her GP (phase 1); each GP was then assigned to the hospital where most of his/her patients were admitted for any cardiac condition (reference hospital) (phase 2). Current administrative data do not allow the identification of the hospital specialist who visited the CHF patient in hospital therefore linkages between providers were created between the GP and the hospital.

The cohort of cardiac patients in phase 1 was identified by selecting all residents aged 18–100 years who had at least one planned or unplanned hospitalization for heart disease, arrhythmia or cardiac decompensation in any public hospital in Tuscany in the three-year period from January 1st 2014 to December 31st 2016 (the diagnostic codes for the identification of CHF patients are reported in the Online Appendix). In phase 1 we included all patients hospitalized for any cardiac condition including CHF, since we hypothesised that linkages between the GP and the hospital-based specialist would hold for similar clinical conditions (i.e., the reference specialist would be the same for all cardiomyopathies). This considers a greater number of cardiac conditions allowing a more accurate identification of GPs and hospital-based networks.

The study cohort included 51,760 patients and 67,674 hospitalizations for cardiac conditions. The patients were then assigned to their GPs. Patients who changed GP during the observation period were assigned to the GP who provided most of the care in the observation period. For each GP, we calculated the distribution of admissions of his/her patients to all Tuscan hospitals over the 3-year period. Based on this distribution, GPs were assigned to a reference hospital - the hospital where the majority of their patients were admitted (phase 2). Through this method we identified 2,881 linkages of GP to hospital which comprised 51,760 patients with cardiac conditions assisted by 2,881 GPs who, in turn, were assigned to 41 reference hospitals. For each pair, we classified the “strength” of the professional linkage (GP to hospital) as strong, moderate and weak. Strong linkages were those for which at least 60 % of the patients of a GP were admitted to the same hospital; moderate linkages were those where 40%–60% were admitted to the same hospital; and weak linkages were those where less than 40 % of the patients were hospitalized to the same hospital, indicating that GPs tended to refer his/her CHF patients to different hospitals (phase 3).

All analyses were performed using the strongest linkage networks only, since we hypothesized that they constitute the highest hospital admission loyalty to allow for optimal performance benchmarking and continuity of care. Out of the 2,881 linkages, we identified 2,062 strong GP-hospital linkages.

The performance evaluation was restricted to CHF patients (cardiac patients having at least one hospitalization for CHF in the 3-year period) who were admitted for CHF to the reference hospital. From these, we obtained 1,965 strong GP - hospital linkages which included 15,841 CHF patients linked to 1,965 GPs and 38 reference hospitals. We based the performance analysis on these networks. The diagnostic codes for the identification of CHF patients are reported in the Online Appendix.

Finally, we ran a validation test to assess how self-contained the networks were. We measured the frequency of CHF patients that had at least one cardiac outpatient visit, one echocardiographic service, or one electrocardiogram delivered in the reference hospitals in the 3-year observation period (January 1st, 2014 to December 31st, 2016). We found that on average, in 74 % of the networks the reference hospital for inpatient services was also the reference hospital for outpatient services.

4.2. Performance measures regarding heart failure care process and outcome

From yearly performance reports of the Tuscan Performance Evaluation System (PES freely accessible online at <http://performance.santannapisa.it/pes/toscana>) that measure and assess multiple healthcare performance dimensions at the provider and AFT levels, we selected evidence-based indicators for CHF. These indicators have been measured and evaluated in individual care settings and shared with practitioners and policy-makers to support performance improvement and alignment with the strategic goals of the health care system [25]. Public reporting of benchmarked

performance, together with clinical involvement in developing the rules and criteria of performance indicators, enable the effective engagement of professionals in discussion and feedback about performance and outcomes.

The indicators, calculated from administrative databases, are:

- Medication adherence: % of patients with two or more prescriptions of beta-blockers within one year of the index hospitalization (C11a.1.4 indicator code on the PES web platform). Indeed, recent research revealed the benefits of treating heart failure patients with long-term beta-blocker therapy especially in patients where there is a IA recommendation [26]. % of patients with two or more prescriptions of ACE inhibitors or ARBs within one year of the index hospitalization (C11a.1.3 indicator code on the PES web platform); and % of patients with two or more prescriptions of anti-aldosterone within one year of the index hospitalization.
- Outpatient follow-up during one year post- index hospitalization: % of patients seen by a cardiologist at least once within one year of the index hospitalization. Evidence reporting that 30-day follow-up after discharge is associated with lower risk of 1-year mortality [27] and early physician follow-up (within 7 days) can further reduce this risk and 30-day readmission rate [28,29]. % of patients having at least one echocardiogram within one year of the index hospitalization; % of patients with at least one measurement of B-type natriuretic peptide (BNP) and N-terminal pro b-type natriuretic peptide (NT-proBNP) within one year of the index hospitalization; and % of patients with at least one creatinine, sodium and potassium level measured within one year of the index hospitalization (C11a.1.2a and C11a.1.2b indicator codes on the PES web platform).
- Outcomes: unplanned readmissions within 30 and 180 days after the index hospitalization excluding patient who died in hospital; 30 and 180 day mortality (including hospital mortality) after the index hospitalization. The index hospitalization was identified by randomly selecting one hospitalization during the study period [30].

Outcomes were indirectly adjusted by age, sex and Elixhauser index through a multiple logistic regression. To compute the Elixhauser index, we adopted the Comorbidity Software Version 3.3 developed as part of the Healthcare Cost and Utilization Project (HCUP) by the Agency for Healthcare Research and Quality (2008) [31].

4.3. Performance measurement

We conducted a two-step analysis. First, we measured the performance indicators at the network level for 2017. Following the methodology of the Tuscan PES [32] for each indicator, the performance of the networks was benchmarked using five-colour evaluation bands defined on the basis of the percentile distribution, where red (poor performance) represents the lowest quintile of the distribution and dark green (excellent performance) the highest, since there are no international or national standards or targets against which to measure performance.

Secondly, to provide an effective graphical representation of shifting the focus from a single organization’s perspectives to the performance of networks as a whole, we displayed the performance indicators along the main phases of the care pathway. This illustration follows the method in Nuti et al. [15] using a 5-band evaluation. This representation displays the pathways’ performance at both primary care and hospital network and at AFT levels, and allows simple recognition of the strengths and weaknesses of performance in the different pathway phases. The AFT representation enables the identification of intra-AFT variation in the performance of different care networks.

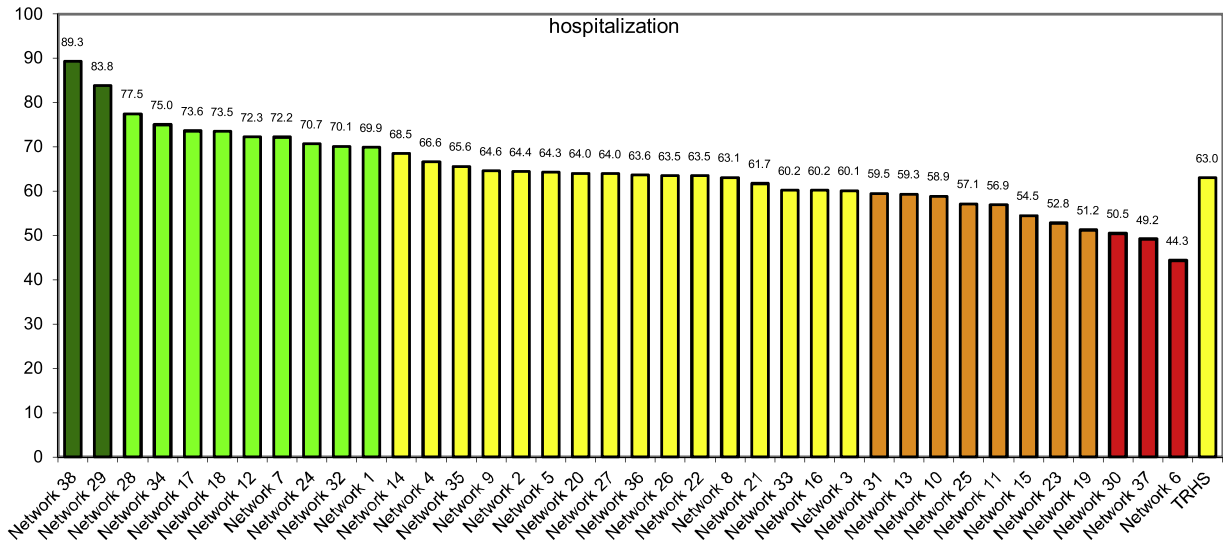


Fig. 1. Percentage of patients with two or more prescriptions of beta-blockers within one year of the index hospitalization.

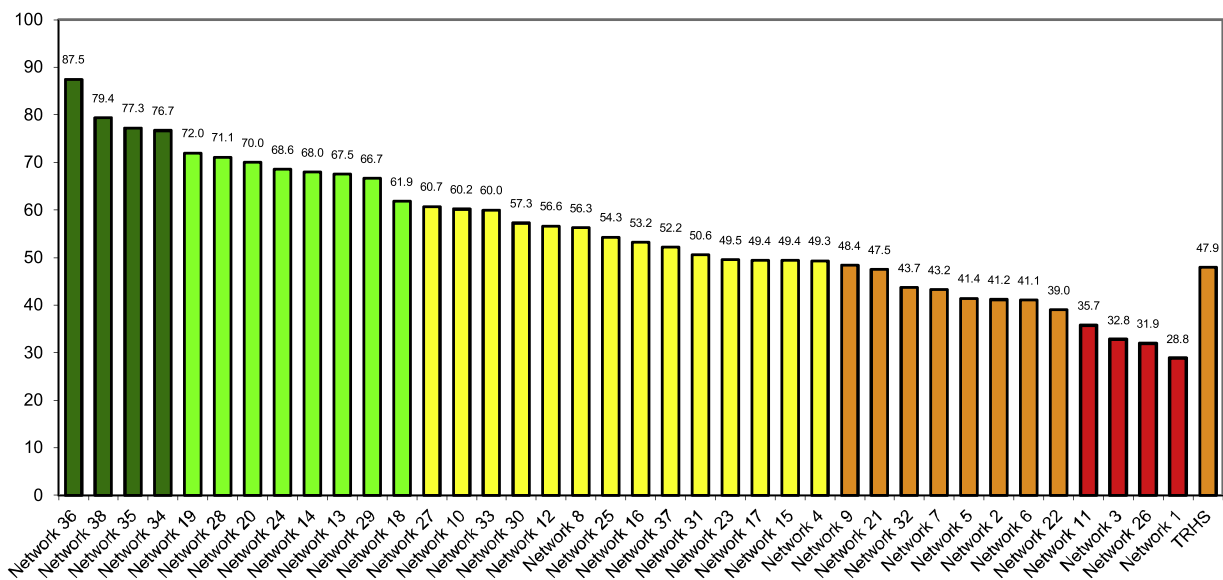


Fig. 2. Percentage of patients with at least one cardiac visit at one year from the index hospitalization.

5. Results

Results show the presence of informal strong links between GPs and hospital based on existing patterns of patient flow, which are not constrained geographically. In particular, out of 1,965 strong GP - hospital linkages, which included 15,841 patients with CHF, linked to 1,965 GPs and 38 reference hospitals, we defined 38 networks to be considered for the performance evaluation analysis. About 49 % of CHF patients are male, with an average age of 81 (range, 20–100 years). 73.5 % of patients had at least one comorbidity as measured by the Elixhauser index (see the Online Appendix for the data of each network). Significant variability in care practice and performance exist among the networks in Tuscany (Figs. 1, 3 and 2 in the Online Appendix).

On average 63 % of Tuscany patients have two or more prescriptions for beta-blockers 12 months post hospitalization (Fig. 1). High performing networks are those with more than 69 % of patients being prescribed beta-blockers (green).

Fig. 2 shows the percentage of patients with at least one cardiac visit within one year of the index hospitalization (range,

28.8%–87.5%). The regional mean is 47.9 %. There is high variability across networks.

When looking at outcome indicators, 30-day adjusted mortality shows significant variability among the 38 networks, from 3.6%–16.8% with average regional 30-day adjusted mortality of 11.6 % (Fig. 3).

Fig. 4 shows the performance of the care delivered to CHF patients by the strong-linking professional networks with 69 GPs distributed in 16 AFTs to a mono-specialty cardiac centre in an urban area of Tuscany. Outcomes for these patients (n = 184) are very good with a statistically significant lower 30-day mortality compared to average 30-day mortality in Tuscany. Adherence to drug therapy is very good (e.g. 80 % of CHF patients have two or more prescriptions for beta-blockers 12 months post hospitalization) as well as good performance in the outpatient follow-ups, with for instance, 73 % of patients having at least one cardiac visit within one year of the index hospitalization but with 41 % of patients with at least one echocardiogram.

An additional focus is on the process and outcome performance of CHF patients cared for by a single AFT. The results of Fig. 5 high-

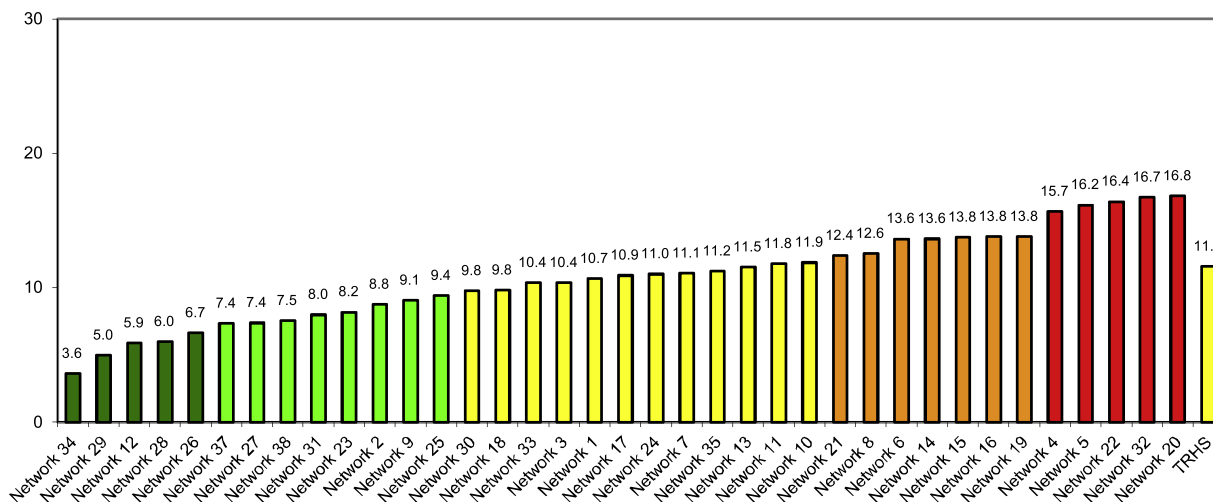


Fig. 3. 30 day adjusted mortality from the index hospitalization.

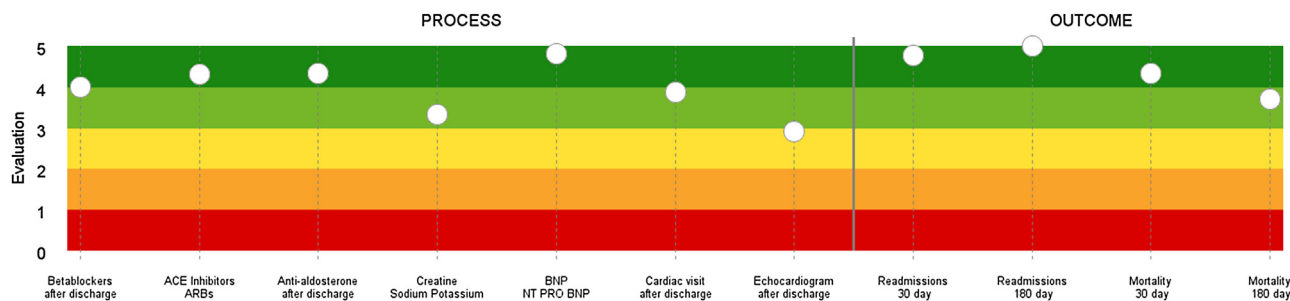


Fig. 4. An example of the CHF pathway displaying the performance of a mono-specialty cardiac centre (Network 28) linked with 69 GPs distributed in 16 AFT.

light the heterogeneity of referral behaviour to specialists within a group of 16 GPs working in the same AFT; 62.5 % have as reference network the number 10, 31.25 % Network number 28 and the remaining 6.25 % Network number 20. We can see that Network 28 has better performance compared to Network 20 and Network 10 on all process and outcome indicators, with the exception of 180-day readmission.

6. Discussion

The study highlights the existence of informal links between GPs and hospitals based on patterns of patient flow. These networks which are not geographically based vary in the intensity of relationships and quality of care. Such informal networks may represent the most effective accountability level for chronic disease management, since they encompass the multiple care settings experienced by patients and overcome some of the limitations of formal integrated care models.

Integrated and coordinated care aims at bridging the boundaries between professions, providers and institutions, and overcoming existing organizational and funding silos. However, the challenges are multiple, and require strategies at the micro, meso and macro levels [33,34]. Numerous examples of micro and meso level approaches have been proposed, such as, focusing on clinical integration or professional integration) as models for integration [35]. However, few macro level action integrated programs have been put in place [33].

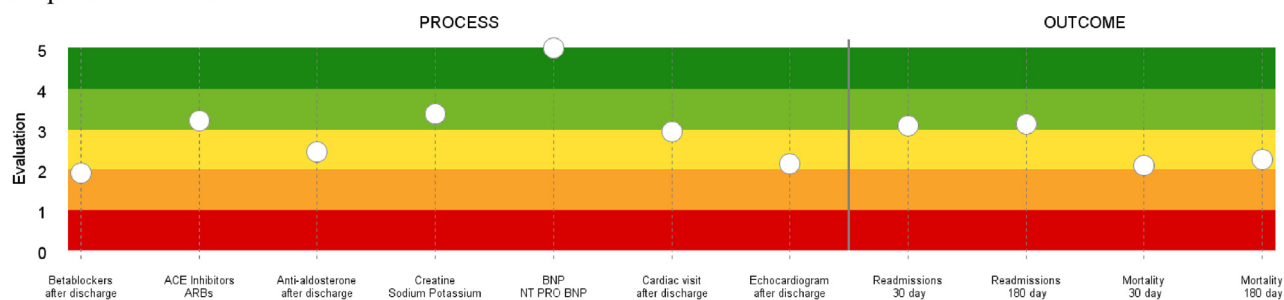
From a health system perspective, several features should be redesigned to incentivize and optimize integration: funding, regulatory mechanisms, management systems such as performance evaluation tools, and financial and human resources management systems. In some healthcare systems, including the Italian, pro-

professionals lack commonly defined objectives, information systems capable of following the patient across different care settings, and mechanisms of joint accountability to monitor outcomes and appropriateness of care [11]. Some examples of health governance built around teams of professionals are the Accountable Care Organizations (ACOs) for Medicare beneficiaries developed in the United States [36], adapted elsewhere as care groups for chronic disease patients (The Netherlands) [37].

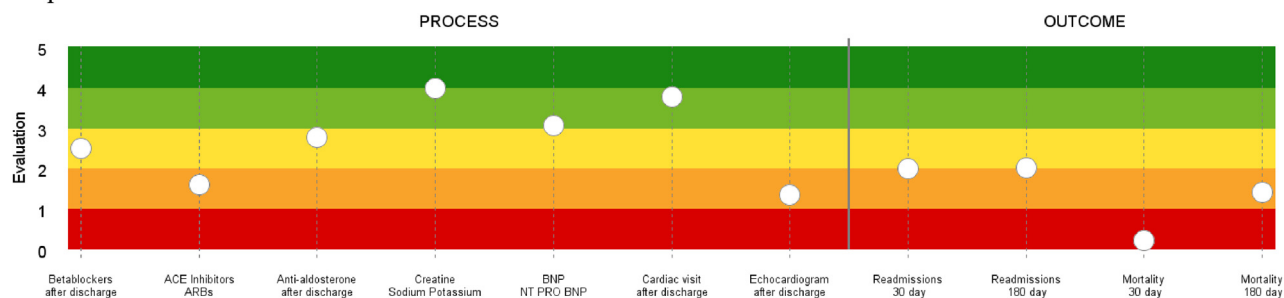
In some settings with market, quasi-market or social security systems, models of care such as ACOs have been proposed. These are intended to shift the pricing system based on volume towards mechanisms to capture the contribution of health professionals working together to deliver outcomes and value. In Beveridge systems where both funding by DRG for hospital activities and capitation funding for general medicine are still focused on care settings and not on patient care, new performance tools are needed to improve the continuity and outcomes of care [38]. In theory, settings of care define the boundaries of professionals' actions. However, in reality, the delivery of medicine is shaped by the independent status of professionals, and reflects their relative autonomy.

Health care professionals are not randomly involved in the care pathway, but are linked to one another through long-standing relationships of trust, creating informal referral networks linking multi-specialist groups of physicians. This leads to the creation of informal professional networks across settings. In the case of CHF, patients are usually referred to the specialist by the GP, who tends to establish connections with a team of specialists with whom they create an informal professional network. Improving the dynamics of inter-professional interactions is a key issue for achieving important organizational outcomes, including the diffusion of best practice, routines [39] and innovation [40,41]. This implies that per-

Graph A - Network 10



Graph B - Network 20



Graph C - Network 28

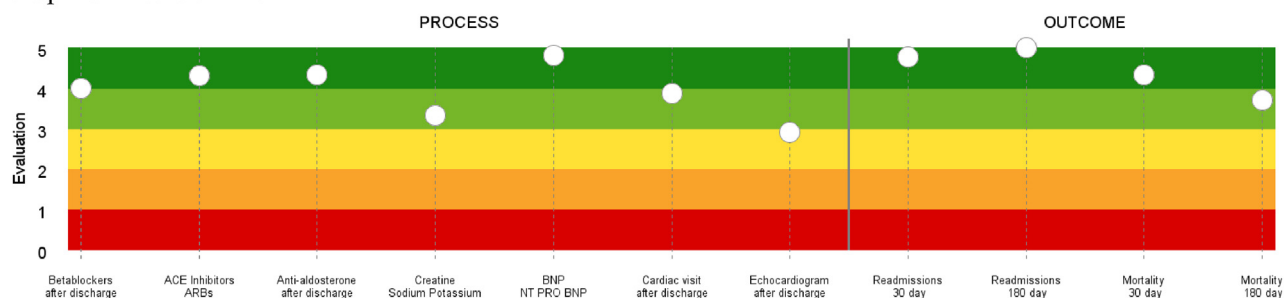


Fig. 5. An example of the CHF pathway displaying the network performance of one AFT with 16 GPs who have strong referral links with three different referral networks (Graph A – Network 10; Graph B - Network 20; Graph C - Network 28).

formance measures should value horizontal relationships between healthcare organizations and professionals, and mitigate professional and organizational barriers to networking [17,42–45]. From this perspective, it is necessary to identify which professionals (providers) have been involved in the care pathway and can be considered co-responsible for the outcomes.

In this light, our work provides a data-driven approach to fill the “responsibility gap” among healthcare professionals, indeed measuring informal networks can identify the professionals involved along the care pathway, and may enhance collaboration. Moreover, PES tracking the results achieved by multispecialty physician networks can improve performance for chronic disease patients through strong primary care, coordinated and integrated care among GPs, specialists, hospitals, engagement of interdisciplinary health professionals [46] and focus on efficiency [47].

The main strengths of our approach lie in the selection of CHF patients based on the primary and hospital care network and the identification of referral networks for reporting quality and performance encompassing multiple care settings. Such primary care - hospital networks showed high accuracy when assessed against outpatient appointments, confirming the strength of the identified networks. Indeed, we found that on average, in 74 % of the networks the reference hospital for inpatient services was also the reference hospital for outpatient services.

Our approach stresses the importance of public reporting of benchmarked performance by encouraging competition for high performance driven by professional reputation [48] and also emphasizes the importance of clinical engagement to create a learning environment in a community of practice where discussion and feedback about performance are conducted. Thus, for effective use of the performance evaluation, provision of feedback and discussion with professionals is essential [49]. Finally, the pathway performance we propose highlights the contribution of each provider / professional in delivering care during each pathway phase, stressing joint responsibility in the overall care pathway performance [15]. By adopting the pathway perspective, attention is directed toward the patient, embracing the value creation paradigm whereby performance systems for coordinated care should aim to include systematic assessment of the patient experience, the level of participation in shared decision-making between patients and providers, and self-management initiatives [50].

Future research could apply this method to other chronic conditions (e.g., complex and multiple chronic conditions) to generalize the results. Moreover, the method should assess and compare the utilization of resources among networks. Beyond the PES, new approaches for resource allocation (e.g., yearly budgeting) based on the needs of cohorts of chronic disease patients should be developed at the network level.

The findings have some limitations because only a subgroup of the CHF population was assessed; indeed, only “strong” linkages between GPs and reference hospital are considered. However, strong linkages are where the locus of responsibilities among settings can be definitively established. Additionally, current administrative data does not allow the identification of the hospital specialist who visited the CHF patient in the reference hospital, so linkages of “professionals to professionals” are not feasible. It will be important to add this dimension in the future, as each professional plays a key role in the care pathway and may help reduce hospital readmissions and increase therapeutic compliance.

7. Conclusions

How can performance measurement systems hold primary care physicians and specialists accountable for the chronic patients they are jointly responsible for? Our case provides supporting evidence that an integrated approach that considers the naturally occurring links between professionals working in different settings may represent the most effective level of accountability for quality evaluation of the care of chronic patients, by encompassing multiple care settings and therefore contributing to efficient, integrated care and quality improvement.

The Tuscan experience in assessing the performance of the heart failure care pathway through the primary and specialist care networks represents an example of an inter-organizational performance assessment system, fostering collaborative practices, networking and shared responsibility between professionals, especially in the management of care pathways for chronic disease patients.

Author contributions

Sabina Nuti: conceptualization, review & editing
 Francesca Ferrè: validation, writing original draft, review & editing
 Chiara Seghieri: methodology, data curation, validation, review & editing
 Elisa Foresi: data curation, formal analysis
 Therese Stukel: methodology, review & editing

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Declaration of Competing Interest

The authors declare that they have no conflicts of interest.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.healthpol.2019.11.001>.

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