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Implications of interprofessional primary care team characteristics for health services and patient health outcomes: A systematic review with narrative synthesis

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ABSTRACT

Interprofessional primary care (IPPC) teams are promoted as an alternative to single profession physician practices in primary care with focus on preventive care and chronic disease management. Characteristics of teams can have an impact on their performance.

We synthesized quantitative, qualitative or mixed-methods evidence addressing the design of IPPC teams. We searched Ovid MEDLINE, Embase, CINAHL, and PAIS using search terms focused on IPPC teams. Studies were included if they discussed the influence of team structure, organization, financial arrangements, or policies and procedures, or either health care processes or outputs, health outcomes, or costs, and were conducted in Australia, Canada, the United Kingdom or New Zealand between 2003 and 2016. We screened 11,707 titles, 5366 abstracts, and selected 77 full text articles (38 qualitative, 31 quantitative and 8 mixed-methods).

Literature focused on the implications of team characteristics on team processes, such as teamwork, collaboration, or satisfaction of patients or providers. Despite heterogeneity of contexts, some trends are observable: shared space, common vision and goals, clear definitions of roles, and leadership as important to good teamwork. The impacts of these on health care outputs or patient health are not clear. To move the state of knowledge beyond perception of what works well for IPPC teams, researchers should focus on quantitative causal inference about the linkages between team characteristics and patient health.

1. INTRODUCTION

In today's complex healthcare environments, effective interprofessional teamwork is promoted to enhance the quality and safety of care provision and health outcomes for patients [1–5]. Interprofessional primary care (IPPC) teams consist of healthcare providers from different disciplines working together to address the health needs of populations through the creation of comprehensive care options, increased continuity, and coordination of care [6–11].

Empirical evidence of the implications of IPPC team design on various aspects of care processes or health outcomes is specific to particular contexts, but a general understanding of optimal team design is not available. Policy makers seek guidance on the design of team characteristics that best support primary care (PC) delivery [12–14]. The goal of our study is to synthesize the available empirical evidence of the implications of team characteristics on team processes, care outputs, and health / cost outcomes. The purpose is to support policy makers in designing IPPC teams that improve PC delivery and positively contribute to population health.

We focus on the experiences of mature and publicly funded health care systems in Australia, Canada, United Kingdom and

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New Zealand. All four countries have undertaken PC restructuring around the turn of the century which embedded an increased reliance on IPPC teams, therefore a focus on their experiences can provide valuable lessons for policy makers. To provide context, we briefly describe core PC initiatives in these countries.

1.1. Primary care reform in Australia, Canada, New Zealand and the U.K

General practice has been a focus of the Australian Commonwealth government, with the objectives of addressing workforce insufficiency and improving long-term coordination of care, especially for patients with chronic conditions [15]. Example of initiatives include: funding incentives for increasing the employment of nurses [16] and mental health nurses [17] in PC, other funding for team care arrangements [18,19], the General Practice Superclinic Programme [20,21] and Sharing Health Care Initiative [22] to encourage multidisciplinary patient-centered care, the Enhanced Primary Care Programme [23] and the Home Medication Review [24,25] to improve pharmacists' involvement in PC. The Canadian Federal Government established a Primary Health Care Transition Fund in 2002 [26,27] that funded Provincial level initiatives [28]. Provinces introduced a variety of reforms aimed at increasing IPPC, including for example the introduction of Family Health Teams in Ontario [29–31], Primary Care Networks in Alberta [32,33], Family Medicine Groups in Quebec [34,35] and several local initiatives in Nova Scotia [36–38]. The U.K. government introduced new governance, organizational and financial structures in the National Health Service. Examples include the Local Pharmaceutical Services contract [39], the replacement of Primary Care Groups with Trusts [40] with space for pharmacists [41], and the Quality and Outcomes Framework consisting of a series of financial incentives for achievement of specific targets [42,43]. The 2001 New Zealand Primary Health Care Strategy encouraged greater teamwork in PC and supported a wider role for practice nurses [44,45].

1.2. Contribution to previous review studies

Our review contributes to the literature in that the scope of our research question is more comprehensive and directly based on the needs of policy decision makers. Other reviews addressed only elements of our study. For example, a recent systematic review explored what makes IPPC teams work well. Mulvale et al. [1] presented a synthesis of nine quantitative studies published between 1990 and 2015 that measured the association between various team characteristics and collaboration [46]. Our review is broader in scope in that we (i) include qualitative evidence, and (ii) consider multiple outcomes of interest. Contandriopoulos et al. [2] reviewed 52 studies of primary care to identify evidence to support role optimization in teams where nurses played a significant role, with the purpose of supporting evaluation of existing models in practice [47]. Our focus was on a variety of team compositions, as well as other team characteristics and the purpose is to inform design. O'Reilly et al. [3] reviewed 49 studies that explored the perspectives of IPPC team members about the meaning of IPPC care, its usefulness, its effectiveness, and also about barriers and facilitators to operationalization [48]. The last item overlaps with our study, however, we followed an a priori categorization of policy relevant team characteristics as potential facilitators and explore studies beyond perceptions of team members. Xyrichis and Lawton [93] published a comprehensive review of factors that affect interprofessional teamwork in primary and community care, which influenced the development of our study protocol. Their review of 43 quantitative and qualitative studies categorized determinants of team care into structural and process characteristics [49]. Our study expanded the potential determinants to include financial and governance structures, includes studies up to 2016, and we followed a systematic and comprehensive approach to identify and synthesize studies [50]. Several other review studies [51–53] are even narrower in scope and are referred to under discussion.

2. Methods

The purpose of our study is to provide guidance for knowledge users in the design of policy instruments to support IPPC teams, therefore all elements of the study protocol was developed in close consultation with our Knowledge User Advisory Group, consisting of a nurse, a primary care physician, and two decision makers.

The study protocol for this review was published in 2016 [13] and was registered in PROSPERO under CRD42016041884. Here we summarize the methods in brief, and elaborate on methodological issues that arose during the course of the review.

We follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [54] and report on: (1) defining the review question (stated above); (2) identifying studies; (3) selecting studies; (4) critical appraisal of studies; (5) collecting data; and (6) synthesizing and interpreting results. A PRISMA Checklist is included in Supplemental Material 1.

2.1. Review question

Our research question was: Among interprofessional teams (population), what is the influence of team characteristics (influence or intervention) on team process or primary care goal (consequence or outcome) in the context of primary care reforms in Western publicly funded health care systems (setting) and focusing on general care, diabetes, asthma, ischemic heart disease, hypertension and multi-morbidity care (conditions)? Primary care goals are often expressed in terms of health care outputs or health outcomes. The influences and consequences are described in more detail in later sections. The research question is divided into three complementary components:

- Influence of team characteristics on team processes.
- Influence of team processes on primary care goals.
- Influence of team characteristics on primary care goals.

Our research question is multidimensional and its components are presented in Table 1.

2.2. Identifying studies

A comprehensive electronic search was conducted with the help of a library scientist using indexed and free text words in the following databases: Ovid MEDLINE, Embase, CINAHL, and PAIS. The details can be found in *Appendix 1*. The primary search focused on four specific conditions: diabetes, asthma, ischemic heart disease and hypertension, the most prevalent PC relevant chronic conditions [55,56], as well as general chronic disease management. On the basis of feedback from the Knowledge User Advisory Group, multi-morbidity was added to the study protocol [13] as a separate search. In addition, reference searches of 25 review studies (Appendix 2) were conducted.

2.3. Selecting studies

The systematic search of the academic literature focused on identifying that informed our research questions as conceptualized with an a priori analytical framework (Table 1). The framework categorizes studies by the nature of the influence of either a structural process characteristic on either team process or a select primary

Table 1
A priori analytical framework.

		INFLUENCES				
		Team Characteristics				Team Process Outcomes
		A. STRUCTURE Composition, size, location	B. ORGANIZATION Governance, organization, leadership, model	C. FUNDING Funding, provider remuneration, funding of space and equipment	D. POLICIES AND PROCEDURES Strategic plans, guidelines, communication	E. TEAM EFFECTIVENESS/ CLIMATE/ FUNCTIONING
CONSEQUENCES	**1. PROCESS OUTCOMES** • Access, • Continuity • Appropriateness • Quality of care/ patient satisfaction • Team climate • Team functioning / provider satisfaction	**A1.** Literature describing the influence of structure on process outcomes. (e.g. How does the addition of a pharmacist influence patient satisfaction).	**B1.** Literature describing the influence of organization on process outcomes. (e.g. How does the leadership model, physician-led team, influence team functioning).	**C1.** Literature describing the influence of funding on process outcomes. (e.g. How does the payment via salaries influence care continuity).	**D1.** Literature describing the influence of policies and procedures on process outcomes. (e.g. How to guidelines influence team functioning).	**E1.** Literature describing the influence of team effectiveness or climate on process outcomes (e.g. How do team climate measures influence patient satisfaction).
	2. HEALTH CARE OUTPUTS • Service composition • Service volumes • Patient numbers	**A2.** Literature describing the influence of structure on health care outputs. (e.g. How does location of the team influence service volumes).	**B2.** Literature describing the influence of organization on health care outputs. (E.g. How does the family health team model influence patient numbers.)	**C2.** Literature describing the influence of funding on health care outputs. (e.g. How does the fee for services payment to physicians influence service composition).	**D2.** Literature describing the influence of policies and procedures on health care outputs. (e.g. How does the strategic plan influence service composition).	**E2.** Literature describing the influence of team effectiveness on health care outputs. (e.g. How does team climate influence patient numbers).
	3. HEALTH OUTCOMES • Various outcomes relevant to diabetes, asthma, ischemic heart disease, hypertension, multi-morbidity.	**A3.** Literature describing the influence of structure on health outcomes. (e.g. How does the addition of a dietician influence the diabetic patients blood sugar levels).	**B3.** Literature describing the influence of organization on health outcomes. (e.g. How does a nurse practitioner led model influence myocardial infarction rates among patients).	**C3.** Literature describing the influence of funding on health outcomes. (e.g. How does team funding based on patient numbers influence hospital versus home birth rates.)	**D3.** Literature describing the influence of policies and procedures on health outcomes. (e.g. How do clear communication plans influence patients' cholesterol measures).	**E3.** Literature describing the influence of team effectiveness on health outcomes. (e.g. How does team climate influence patients' mental health measures.)
	4. COST OUTCOMES • Costing studies • Cost-effectiveness studies	**A4.** Literature describing the influence of structure on cost outcomes.	**B4.** Literature describing the influence of organization on cost outcomes.	**C4.** Literature describing the influence of funding on cost outcomes.	**D4.** Literature describing the influence of policies and procedures on cost outcomes.	**E4.** Literature describing the influence of team effectiveness on cost outcomes.

care goal (consequence). For example the influence of team size on a measure of patient satisfaction (Table 1, *cell A1*), or the influence of team funding models on the percentage of diabetic patients with blood sugar levels at target (Table 1, *cell C3*). Only primary qualitative, quantitative and mixed methods studies [57] in the English language were included.

Initial selection criteria were refined twice during the course of the study. Given the large volume of titles generated from the search, and following a preliminary screening of a subset of search results (150 titles, Feb 2016), the inclusion criteria were refined further for specificity and feasibility. We decided to include studies of teams targeting stroke, cancer, geriatric care, or mental health, and exclude studies focused on end-of-life care or addictions (condition). In July 2017, due to budgetary constraints, we decided to limit our study to four countries: Australia, Canada, United Kingdom and New Zealand, given that these countries underwent major primary care reforms since the turn of the century, and have common roots in the development of their socio-political systems under Westminster governments of the British Commonwealth. Furthermore, studies predating 2003 were dropped, given that the early 2000s marked primary care reforms in these four countries. Given the timing of this decision, title and abstract results reported include studies pre-dating 2003. A search of grey literature was proposed in the study protocol [13], but given the paucity of desired studies, it was not conducted.

Studies were selected in three stages. At every stage, each item was assessed by two independent reviewers (pairs of authors). During the first stage irrelevant titles not pertaining to the study topic were excluded. In cases of uncertainty regarding inclusion on the basis of title alone, studies advanced to the next stage. During the second stage, abstracts were reviewed for fit into the analytical framework in Table 1. Abstracts lacking detail but with the potential to inform the study, advanced. During the third stage full articles were reviewed to assess all selection criteria. Studies were excluded during the full text review when their content did not fit into the analytical framework, in that they did not

describe an association between influencer(s) and consequence(s). The following were reasons for exclusion: did not address relationship between team structure, team process, and/or health system outcome (wrong content); focus on aspects of care beyond our described scope, e.g. addiction, end-of-life care (wrong condition) or e.g. secondary hospital care (wrong setting); focus on education of providers, patient perspectives, process description (wrong outcomes). Disagreements in stages two and three were discussed with the goal of consensus, and a third reviewer (lead author) was engaged in situations of an impasse.

The *Covidence* systematic review software [58] was used to support the title and abstract screening stages. The *Microsoft Excel* package was used to support the full text review, extraction and quality rating stages.

2.4. Data extraction and analysis of studies

We extracted characteristics for each study meeting inclusion criteria using a data extraction tool (Appendix 3): research question, population, care setting, study design, type of data, analysis, results and conclusion. Quantitative studies were qualified in line with the integrated approach taken [59–62]. Information was extracted about the structural characteristics of the IPPC team described (policies, procedures, team composition, provider remuneration, team funding, team governance), and the care process outcome that was investigated in the study (team process, health services process, care outputs, health outcomes for the selected conditions, or costs). In each case, influences and consequences were identified and the study was placed in one or several cells of the analytical framework based on study objectives.

2.5. Critical appraisal of studies

Each study was assessed for methodological quality using the Mixed Methods Appraisal Tool (MMAT), which allows rating the quality of studies along a four-point scale. The MMAT is designed for the appraisal of complex systematic literature reviews that combine qualitative, quantitative and mixed methods studies [63,64]. The tool relies on two screening questions, followed by an assessment of four criteria relevant to each study type, each with multiple sub-criteria. Each study was assigned a rating on the basis of criteria met (* one criterion met to **** all criteria met).

2.6. Synthesis and interpretation of results

Our synthesis is narrative [65–67] and follows a data-based convergent design [50]. The analytical framework (Table 1) was used for the organization of studies, and the narrative approach was taken to describe what is known about each element of the framework [65,68]. The MMAT quality rating is included in the populated analytical framework (Table 2), and the synthesis includes an overall strength of the evidence assessment following the scheme: Strong evidence of a link between influence and consequence (more than one study with an MMAT rating of ****); moderate evidence (one or more studies with an MMAT rating of ***); limited evidence (one or more studies with an MMAT rating of ** or *), conflicting evidence (inconsistent findings across studies with MMAT ratings of *** or ****), and no evidence (no studies, or conflicting findings with MMAT ratings of ** or *).

3. Results

We retrieved and screened 11,707 titles (9888 during the initial search; 1330 during a subsequent search to include multimorbidities; 304 through bibliographical searches of included studies; and 185 through bibliographical searches of review studies), screened 5366 abstracts, and included 488 studies in a full text review, as per PRISMA flowchart (Fig. 1). Given the nature of the study question, the full text review phase was extensive and in many cases the only option for assessing the fit of the study. The final number of studies meeting the selection criteria and included in the synthesis was 77. Their placement in the analytical framework and their MMAT rating is provided in Table 2, and their content is synthesized in the narrative below.

A review of a trial set of titles was completed in February 2016, and the initial library database searches were initiated in March 2016. A subsequent library database search was conducted in May 2016 to include multi-morbidities. Bibliographical reference searches were ongoing. The final extraction phase was completed in April 2018, and the placement of studies in the analytical framework ended in August 2018.

3.1. Study characteristics

The majority of included studies were qualitative (38), and the majority of studies were from Canada (41), followed by Australia (20) (Table 3). The MMAT ratings for most studies were three or four stars. In our observation, the MMAT rating tended to favour qualitative studies, because the rating criteria appear more interpretive.

3.2. Influences of characteristics of IPPC teams on selected primary care goals

Studies were assigned into cells of the analytical framework (Table 2) according to the influence-consequence relationship they capture. To illustrate the speculated chain of causation and the directness of the influence-consequence relationship between the various elements in the analytical framework, we developed a logic model (Fig. 2), which builds on models used in previous studies [46,53,69–72]. Team characteristics are speculated to have a direct influence on team and care processes, and a mediated and indirect influence on health care outputs and health outcomes. Costs can be assessed in relation to each of the logic model elements. We synthesize and interpret the literature in the context of the logic model to help assess not only the existence, nature, quality and strength of evidence (results), but also its meaning and value for purposes of policy and planning (discussion).

3.3. Influences on team or care processes

Conceptually, processes are influenced by team characteristics most directly. The majority of empirical evidence included in our review focuses on these influences. They are captured by categories across the first row of the analytical framework, specifically in cells A1 (n = 18), B1 (n = 11), C1 (n = 15), D1 (n = 23) and E1 (n = 2). For interpretation of the strength of evidence, consult the disaggregated synthesis in Table 4.

The addition of specific professions to teams was generally positively associated with care processes, but evidence is of moderate strength. For example, the addition of nurses or the expansion of their role improved care coordination [73,74], and satisfaction of providers and patients [44,75]. The addition of pharmacists was more challenging, but collaboration with general practitioners proved possible [76], albeit with limited impact on practice [77]. Strong evidence was found that increases in the ratio of non-clinical to clinical staff had a negative impact on team climate, whereas a general assessment of team size had mixed implications for access, comprehensiveness and continuity [29,78,79].

Co-location of providers working in a team was perceived to improve contacts between providers [40], and increase collaboration [39], in some cases minimally [24]. Co-location also offered

Table 2
Assignment of Studies into the Analytical Framework, MMAT ratings, strength of evidence statement.

	Team Characteristics				Team Process Outcomes
	A. STRUCTURE	**B. ORGANIZATION**	**C. FUNDING**	**D. POLICIES AND PROCEDURES**	**E. TEAM EFFECTIVENESS/ CLIMATE/ FUNCTIONING**
1. PROCESS OUTCOMES	QUANTITATIVE (strong evidence) Coventry et al. 2015 [4]**** Davey at al. 2005 [74]**** Devlin et al. 2013 [5]**** Haggerty et al. 2008 [6]**** Jesson and Wilson 2003 [7] ** Proudfoot et al. 2007 [8] **** Sellors et al. 2003 [9] *** MIXED (moderate evidence) Bradley et al. 2008 [10] *** Legault et al. 2012 [11] ** QUALITATIVE (strong evidence) Al Sayah et al. 2014 [12] **** Dey at al. 2011 [73] *** Ehrlich et al. 2011 [13] **** Finlayson and Raymont, 2012 [14] ** Freeman et al. 2012 [15] * Goldman et al. 2010 [16] **** Howard et al. 2003 [17] **** MacNaughton et al. 2013 [18] **** Patterson et al. 2007 [19] *	QUANTITATIVE (moderate evidence) Harris et al. 2011 [20]*** MIXED (moderate evidence) Bradley et al. 2008 [10]*** Martin-Misener et al. 2009 [21]**** QUALITATIVE (strong evidence) Al Sayah et al. 2014 [12]**** Allan et al. 2014 [22]*** Charles-Jones et al. 2003 [116]**** Cioffi et al. 2010 [23]*** Gaboury et al. 2009 [24]*** Goldman et al. 2010 [16]**** MacNaughton et al. 2013 [18]**** McDonald et al. 2012 [25]****	QUANTITATIVE (moderate evidence) Devlin et al. 2013 [5]**** Dobson et al. 2006 [26] *** Finlayson and Raymont 2012 [14]** Happell et al. 2013 [27]* Laubscher et al. 2009 [28]*** MIXED (limited evidence) Oelke et al. 2014 [29]** QUALITATIVE (strong evidence) Bareil et al. 2015 [30] *** Ehrlich et al. 2011 [13] **** Freeman et al. 2012 [15]* Gaboury et al. 2009 [24]*** Maisey et al. 2008 [31]**** Nacarella 2009 *** Pullon et al. 2009 [32]**** Van et al. 2011 [33]*** Wranik et al. 2017[34]	QUANTITATIVE (moderate evidence) Dieleman et al. 2004 [35]** Dobson et al. 2006 [26]*** Larkin and Callaghan 2005 [36]*** MIXED (moderate evidence) Johnson et al. 2011 [69]**** Legault et al. 2012 [11]** Oelke et al. 2014 [29]** QUALITATIVE (strong evidence) Al Sayah et al. 2014 [12]**** Asselin et al. 2016 [37]*** Bailey et al. 2006 [38]*** Bareil et al. 2015[30] *** De Stampa et al. 2012 [117]*** Gaboury et al. 2009 [24]*** Goldman et al. 2010 [16]**** Gucciardi et al. 2016 [39]*** Kotecha et al. 2015 [40]**** MacNaughton et al. 2013 [18]**** O'Neill and Cowman 2008 [41]*** Pullon et al. 2011 [42]**** Pullon et al. 2009 [32]**** Sargeant et al. 2008 [43]*** Shaw et al. 2005 [44]*** Suter et al. 2009 [45]*** Van et al. 2011 [33]***	QUANTITATIVE (strong evidence, some confict) Hann et al. 2007 [46]**** Proudfoot et al. 2007 [8]****
2. HEALTH CARE OUTPUTS	QUANTITATIVE (strong evidence, conflict) Fletcher et al. 2012 [47] **** Graham et al. 2006 [48] *** Hogg et al. 2009 [49] **** Lawson et al. 2012 [50] **** Sellors et al. 2003 [9] *** MIXED (moderate evidence) Russel et al. 2009 [92] *** QUALITATIVE (strong evidence) Bajorek et al. 2015 [51] *** Donnelly et al. 2014 [52] *** Dufour et al. 2014 [53] **** Grimmer-Somers et al. 2008 [54] ** Gucciardi et al. 2015 [118] **** O'Neill and Cowman 2008 [41] ** Reay et al. 2006 [55] ****	QUANTITATIVE (strong evidence) Carter et al. 2016 [56]**** Farris et al. 2004 [57]*** Hogg et al. 2009 [49]**** MIXED (moderate evidence) Mitton et al. 2007 [58]**** Russel et al. 2009 [92]***	QUALITATIVE (srong evidence) Bajorek et al. 2015 [51]*** Dufour et al. 2014 [53]**** Maisey et al. 2008 [31]**** Merrick et al. 2014 [59]**** Patterson et al. 2007 [19]* Pearce et al. 2011 [60]**	QUANTITATIVE (moderate evidence) Zwar et al. 2007 [61]***	QUANTITATIVE (moderate evidence) Hann et al. 2007 [46]****

Table 2 (*Continued*)

	Team Characteristics				Team Process Outcomes
	A. STRUCTURE	**B. ORGANIZATION**	**C. FUNDING**	**D. POLICIES AND PROCEDURES**	**E. TEAM EFFECTIVENESS/ CLIMATE/ FUNCTIONING**
3. HEALTH OUTCOMES	QUANTITATIVE (strong evidence, conflict) Afzali et al. 2013 [62] *** Beaulieu et al. 2013 [63]*** Coventry et al. 2015 [4] **** Davey at al. 2005 [74] **** Hogg et al. 2009 [49] **** Lawson at al. 2012 [50] **** McLean et al. 2008 [64] *** O'Reilly et al. 2007 [65] **** Richards et al. 2013 [66] **** Simpson et al. 2011 [67] **** Taylor et al. 2005 [68] *** QUALITATIVE (moderate evidence) Reay et al. 2006 [55] ****	QUANTITATIVE (moderate evidence, conflict) Farris et al. 2004 [57]*** Johnson et al. 2014 [69]*** Hogg et al. 2009 [49]**** Karnon et al. 2013 [70]*** McRae et al. 2008 [71]*** MIXED (strong evidence, conflict) Martin-Misener et al. 2009 [21]**** Mitton et al. 2007 [58]****	QUANTITATIVE (moderate evidence) Beaulieu et al. 2013 [63]***	QUANTITATIVE (moderate evidence) Zwar et al. 2007 [61]***	QUANTITATIVE (moderate evidence) Beaulieu et al. 2013 [63]***
4. COST OUTCOMES	QUANTITATIVE (strong evidence) Afzali et al. 2013 [62]*** Dufour et al. 2014 [53]**** Gray et al. 2010 [72]**** O'Reilly et al. 2007 [65]**** Sellors et al. 2003 [9]***	QUANTITATIVE (moderate evidence) Karnon et al. 2013 [70]*** McRae et al. 2008 [71]*** MIXED (moderate evidence) Martin-Misener et al. 2009 [21]****	QUALITATIVE (moderate evidence) Reay et al. 2006 [55]****	(no evidence)	(no evidence)

●Each cell contains the studies providing evidence about the linkage between the influence in the column and the consequence in the row.
●Studies may appear multiple times in the framework if they address several dimensions of our review.
●A summary of each study is provided in *Supplemental Material 2*, which includes a column mapping how the study was fitted into the influence-consequence analytical framework.

convenience for patients [41]. The importance of available shared space and equipment as a facilitator for collaboration was emphasized [21,28,80–82].

Broad overarching policies or positions of official bodies in the U.K, Canada and Australia were perceived to have negative influences on teamwork [83] and professional power dynamics [84], no influence on collaboration and integration [39], and mixed implications for patient assessed quality of care [85,86]. A ground level approach in Canada seemed to have had a positive influence on collaboration between providers [37].

Leadership and the right person in the leadership position were identified in several qualitative studies as important to general team function and success [22,28,80,82,87]. Discussions of leadership models or qualities of good leaders were not provided.

Similarly, much of the literature acknowledged that financial arrangements were an important issue, but did not assess concrete modalities. In several qualitative studies, respondents identified that funding support was important to the development of IPPC teams [21,25,88], and that the absence of adequate funding or remuneration was an obstacle to team work, collaboration or team integration [83,89,90]. Only Nacarella argued that a focus on financial arrangements was not warranted as a tool for improving team work [18].

Specifically, the funding available through the Mental Health Nurse Incentive Program in Australia was considered to have increased collaboration with GPs [17], but more generally the remuneration of coordination activities under the Australian Medical Benefits Scheme was characterised as unnecessarily complicated [73]. The Quality and Outcomes Framework in the U.K. was assessed to have increased teamwork and the job satisfaction of nurses [43]. Studies of financial arrangements in Canada suggested that pooling of funds at the team level and uniform remuneration of providers best support collaboration, whereas physician fee-for-service models were least effective [27,33]. A study of revenue sharing between physicians in one team revealed that this did not influence access, comprehensiveness, or continuity [29]. In New Zealand, fee-for-service arrangements were considered problematic; preferred approaches to support teamwork were population based capitation models for practices [45], and salaries for providers [44].

Both qualitative and quantitative studies highlighted the importance of clear and explicit definitions of roles, responsibilities and scopes of practice of the various providers within a team as a

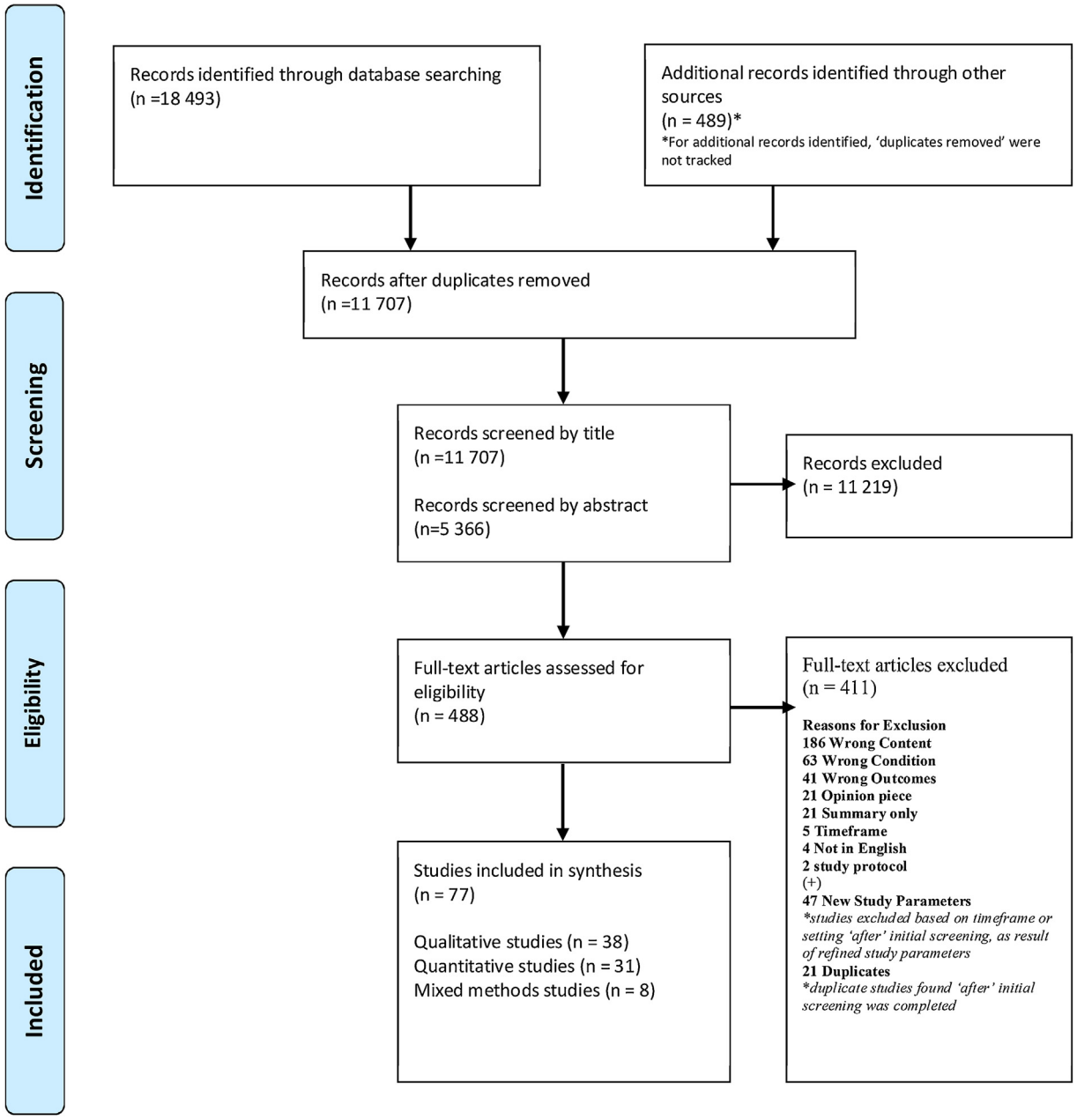

Fig. 1. PRISMA Flowchart.

core facilitator of team function [22,28,33,38,73,81,82,91–97]. Similarly, the importance of a shared vision and goals was consistently stressed [28,33,45,98].

Furthermore, studies identified the usefulness of developing clear protocols and processes for communication, collaboration, patient care and other aspects of teamwork [22,38,80,81,88,93–96,99,100], and discuss the importance of team meetings [25,38,87,95–97]. Some quality improvement processes were found to positively influence teamwork, including a learning collaborative program [101] and performance feedback [30].

Measures of team culture (Competing Values Framework) and team climate (Team Climate Inventory) were shown to be positively associated with continuity of care [42], and provider satisfaction [78]. Influence on patient satisfaction was positive in Australia [78], but not significant in the United Kingdom [42].

3.4. Influences on health care outputs

Health care outputs are the tangible services provided by the health care system and are indirectly influenced by team characteristics. The most direct impact is on the breadth of available

Table 3
Study characteristics (n = 77).

	Qualitative (n=38)	Quantitative (n=31)	Mixed (n=8)
Australia (n=20)	13 Bailey et al 2006 [38]*** Bajorek et al. 2015 [51]*** Cioffi et al. 2010 [51]*** Dey et al. 2011 [23]*** Ehrlich et al. 2011[73] **** Freeman et al. 2012[13] * Grimmer-Somers et al. 2008 [15]** McDonald et al. 2012[25] **** Merrick et all. 2014 [59]**** Nacarella 2009 *** Patterson et al. 2007 [19]* Pearce et al. 2011 [60]** Van et al. 2011[33] ***	6 Afzali et al. 2003 [62]*** Happell et al. 2013 [27]* Harris et al. 2011 [20]*** McRae et al. 2008 [71]*** Proudfoot et al. 2007 [8]**** Zwar et al. 2007 [61]***	1 Karnon et al. 2013 [70]***
Canada (n=41)	18 Al Sayah et al. 2014 [12]**** Asselin et al. 2016 [37]*** Donnelly et al. 2014 [52]*** Dufour et al. 2014 [53]**** Gaboury et al. 2009 [24]*** Goldman et al. 2010 [16]**** Gucciardi et al. 2008 [118]**** Gucciardi et al. 2015 **** Howard et al. 2003 [17]**** Bareil et al. 2015 [30]*** Kotecha et al. 2015 [40]**** Legault et al. 2012 [11]** MacNaughton et al. 2013 18]**** Oelke et al. 2014 [29]** Reay et al. 2006 [55]**** Sargeant et al. 2008 [43]*** Suter et al. 2009 [45]*** Wranik et al. 2017[34]	19 Beaulieu et al. 2013 [63]*** Carter et al. 2016 [56]**** Devlin et al. 2013 [5]**** Dieleman et al. 2004 [35]** Dobson et al. 2006 [26]*** Farris et al. 2004 [57]*** Fletcher et al. 2012 [47]**** Graham et al. 2006 [48]*** Gray et al. 2010 [72]**** Haggerty et al. 2008 [6]**** Hogg et al. 2009 [49]**** Johnson et al. 2014 [69]*** Laubscher et al. 2012 [28]*** Lawson et al. 2012 [50]**** McLean et al. 2008 [64]*** O'Reilly et al. 2007 [65]**** Sellors et al. 2003 [9]*** Simpson et al. 2011 [67]**** Taylor et al. 2005 [68]***	4 Johnson et al. 2011 [69]**** Martin-Misener et al. 2009 [21]**** Mitton et al. 2007 [58]**** Russel et al. 2009 [92]***
U.K. (n=14)	5 Allan et al. 2014 [22]*** Charles-Jones et al. 2003 [116]**** De Stampa et al. 2013 [117]*** Maisey et al. 2008 [31]**** Shaw et al. 2005 [44] ******	7 Afzali et al. 2003 [62]*** Coventry et al. 2015 [4]**** Davey et al. 2005 [74]**** Hann et al. 2007 [46]**** Larkin and Callaghan 2005 [36]*** O'Neill and Cowman 2008 [41]*** Richards et al. 2013 [66]****	2 Bradley et al. 2008 [10]*** Jesson and Wilson 2003 [7]**
New Zealand (n=3)	2 Pullon et al. 2011 [42]**** Pullon et al. 2009[32] ****		1 Finlayson and Raymont 2012 [14]**

* to **** indicates the MMAT quality rating.
The sum of studies by country in the table is 78 not 77, because [62] includes data from Australia and U.K. and is included twice.

services through the inclusion of a variety of professions. Described below are studies captured across the second row in the analytical framework (n = 16).

Care appropriateness in the sense of patients receiving a greater percentage of recommended or needed tests and services was improved with new models of care [26,31], the use of multidisciplinary care plans [23], and the addition of nursing professionals [31,36,100,102]. Team function measures were not significantly associated with appropriateness [42].

Appropriateness of medication use was positively influenced with the addition of a pharmacist in one study in Ontario [103], whereas a second study in the same context did not detect an impact [74].

The size of a team did not influence provision of preventive services or chronic disease management [29], but the addition of new professions, including pharmacists [20], occupational therapists [104], physiotherapists [105], dieticians, podiatrists, and diabetes educators [106,107] was found to increase the breadth of services available to patients. Furthermore, opportunities for appropriate task sharing were identified in interviews [108]. The breadth of services was also influenced by financial arrangements [19], although concern was expressed that clinical appropriateness might be compromised due to skewed financial incentives [15,43]. Not surprisingly, the absence of funding for specific professionals limited teams' abilities to offer their services [20,105], whereas funding from multiple sources could create situations of gaps or duplication of care [74].

The introduction of new models of primary care by governments in several Canadian provinces was associated with reductions in the use of hospital services, such as avoidable emergency room visits related to diabetes complications [35], reduced emergency visits and hospitalizations [109] and reduced hospital days, hospital admissions, and visits to the ER [110].

3.5. Influences on health outcomes

Health outcomes are indictors of patient health measured objectively on patients or subjectively by patients, such as self-assessed health status. Objective markers typically include specific measures such as blood pressure, HbA1c, cholesterol and mental health symptoms, or indices built with combinations thereof; self-assessed health is more general, for example quality of life. Studies included here are quantitative in whole or in part. Health outcomes

Table 4
Narrative summary statements about the influence of team characteristics on health care goals.

	Team Characteristics				Team Process Outcomes
	A. STRUCTURE	B. ORGANIZATION	C. FINANCIAL ARRANGEMENTS	D. POLICIES AND PROCEDURES	E. TEAM EFFECTIVENESS/ CLIMATE/ FUNCTIONING
1. PROCESS OUTCOMES	Strong evidence that addition of new health care providers is perceived positively, addition of non-clinical staff is viewed negatively, and overall team size has mixed implications for teamwork. Strong, predominantly qualitative evidence that co-location, shared space and shared equipment are viewed as important facilitators to collaboration and team work.	Context-dependent strong qualitative evidence that top-down policies were perceived negatively in several contexts, and a bottom-up approach was perceived positively in one case. Strong qualitative evidence that strong and appropriate leadership are perceived as important. No evidence of the type of leadership model that works well/ best.	Moderate qualitative evidence that funding is considered important, and absence of funding is perceived as a barrier to team work. Moderate evidence that FFS approaches are considered to hinder, and pooled funds with salaries support team work in Australia and Canada.	Strong qualitative and moderate quantitative evidence that team members perceive several policy related issues as critical to team work. These include a clear description of roles and responsibilities of all members, a shared vision, shared goals, and clear protocols and processes for communication, collaboration, patient care and other aspects of team work.	Strong quantitative evidence that team climate was associated with care continuity and provider satisfaction, conflicting evidence regarding patient satisfaction.
2. HEALTH CARE OUTPUTS	Moderate, conflicting evidence, about the addition of pharmacists having an effect on the appropriateness of medications used by patients. Strong qualitative and quantitative evidence of a positive impact of adding practice nurses on the provision of recommended tests, screens, and preventive services. Strong qualitative evidence that the range of services expanded with the addition of new types of health care providers.	Strong quantitative evidence that new models of primary care in Ontario were associated with reduced use of hospital use. Moderate quantitative evidence that new models of primary care in Ontario were associated with improved chronic disease management.	Strong qualitative evidence that pay-for-performance arrangements are perceived to increase provision of billable services (at expense of other services). Moderate qualitative evidence that the lack of funding is perceived as a barrier to providing specific services.	Moderate quantitative evidence that a particular approach to long term care planning in Australia increased utilization of appropriate services by diabetic patients.	Moderate quantitative evidence that team climate was not associated with treatment targets for chronic disease management.
3. HEALTH OUTCOMES	Strong quantitative and conflicting evidence of improved chronic disease (e.g. diabetes, depression) management markers. Many studies observed improvements with the addition of various health care providers, but several did not find the expected effects.	Evidence is mixed. Quantitative evidence that new models of primary care were associated with improvements in some physical and mental health markers in Canada and Australia, and strong evidence of no association with other physical and mental health markers in Canada.	Moderate quantitative evidence of remuneration methods having no impact on treatment targets.	Moderate quantitative evidence that a particular approach to long term care planning in Australia improved health indicators for diabetic patients.	Moderate quantitative evidence that team climate was not associated with health targets for patients with chronic diseases.
4. COST OUTCOMES	Variation in contexts from which evidence is drawn is too large for general trends to be identified.	Variation in contexts from which evidence is drawn is too large for general trends to be identified.	Moderate qualitative evidence that a capitation model, as compared to a FFS model, is perceived to support team expansion.	No evidence.	No evidence.

Strong evidence (more than one study with an MMAT rating of ****).
Moderate evidence (one or more studies with an MMAT rating of at least ***).
Limited evidence (one or more studies with an MMAT rating of ** or *).
Conflicting evidence (inconsistent findings across studies with MMAT ratings of *** or ****).
No evidence (no studies, or conflicting findings with MMAT ratings of ** or *).

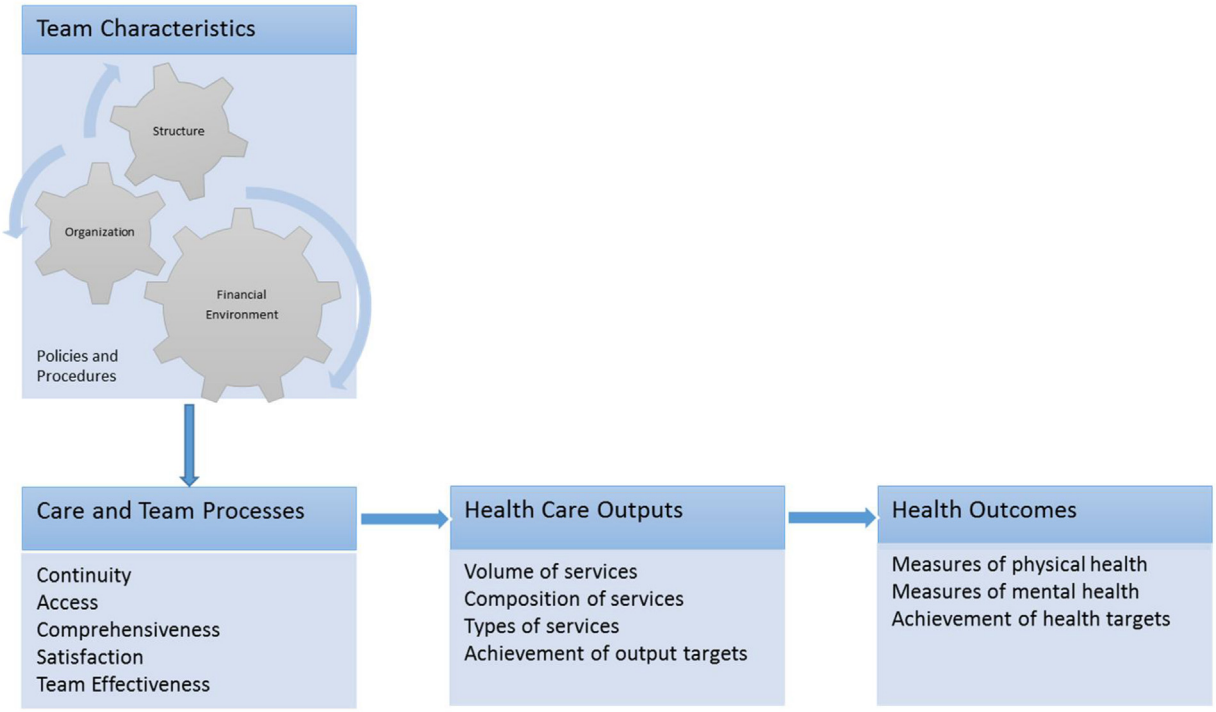

Fig. 2. Logic Model of IPPC Teams influences on processes,outputs and outcomes.

were assessed in 23 studies, primarily as resultant from varied team compositions (cell A3) or whole new models of care (cell B3).

In general, the inclusion of new types of providers was associated with improved health markers. For example, the improvements in some or all diabetes relevant interim markers (HbA1c, BP, LDL cholesterol) were observed with the addition of a pharmacist [111,112], a nurse practitioner or a nurse [36,111–113]. The addition of mental health care providers improved measures for depression [75,115]. Self-assessed health status improved with expanded teams [16], as did the ability of older patients to remain in their homes [40], and also visits to the emergency room decreased [108]. Several studies, however, did not detect changes in specific health outcomes (e.g. glycemic levels, functional status, quality of life measures) following the inclusion of additional health professionals in teams [34,75,26,115].

New models of primary care in Canada had mixed results. Improvements were observed in physical health measured via the RAND-12 inventory [109], reduced depressive symptoms and diabetes related stress [32], and patients' self-reported well-being [110]. No improvements were observed in glycemic control, diabetes, functional status or quality of life [26], HbA1c, BP nor LDL cholesterol measures [32] nor psychosocial scores [37]. New remuneration methods or team effectiveness measures had no significant impact on treatment targets, such as blood pressure, LDL cholesterol, and HbA1c control [34].

Australian studies detected patient weight loss in a novel PC model targeting obesity [116], and increases in estimated life years and quality adjusted life years for diabetic patients in a simulated model [117].

3.6. *Influences on cost outcomes*

Comparatively few studies (n = 9) measured cost implications of various IPPC team characteristics. All such studies were specific to their context, utilized varied methodological frameworks and provided varied results. Studies focused on the cost implications of adding a specific type of provider [16,74,105,108,116,118] or offering new models of care [37,114,117]. In all cases, criteria for the judgement of results were not specified (e.g. a cost-effectiveness threshold, or a total budget). Given the diversity of studies, conclusions could not be drawn.

4. Discussion

Based on our synthesis of the reviewed studies, we could extract some general recommendations for the design of IPPC teams that are supported by strong evidence. In addition, our review also provides insight into recommendations that are reasonable, but based on weaker evidence, and remaining questions for which evidence is insufficient.

We found strong qualitative evidence to suggest that team process, variously defined, were positively influenced by a number of characteristics and policy makers should therefore ensure they are in place. Teams benefitted from the addition of new providers (especially nurses), shared space and equipment, bottom-up policy development, appropriate leadership, and clarity and transparency in terms of goals, roles, scopes of practice and procedures. We consider qualitative approaches most appropriate in the assessment of process and when perception/ knowledge of lived experience (e.g. providers within a team) are the object of inquiry. We also found strong quantitative evidence that the addition of new providers and new models of care is associated with increases in the provision of recommended tests and preventive services, and a decrease in the use of hospitals.

While adding new providers and ensuring that processes are in place to support teams is an evidence supported approach, our knowledge of the cost implications of doing so appears insufficient. Our search picked up studies of the implications of team characteristics specifically on costs-as-outcomes, however. A follow-up review of studies with a targeted search of the cost-implications of any aspects of primary care reform would be of great interest to policy makers.

Our synthesis also revealed a positive trend that suggests the addition of new health care providers, new models of care and/or

new approaches to planning have benefits in chronic disease management in terms of desired outputs and improved health outcomes. While the implications of team structure and organization for health outputs and outcomes are frequently studied (the volume of work is highest in the process row, n = 51, and the structure/organization columns, n = 58), the evidence is of moderate strength, conflicting or both. In general, we have insufficient evidence to make statements about the implications of team characteristics on health outcomes.

There is interest in the impacts of financial arrangements, as evidence by the volume of work, but the evidence is of moderate strength. Furthermore, qualitative discussion of perceptions of financial arrangements is arguably not the most appropriate approaches to address this question. This is consistent with one other review study of facilitators and barriers to team implementation [48], but was not flagged as a determinant of team function among studies reviewed by [46,49]. The review by McDonald et al. [75] specifically focuses on the impacts of funding models on primary care outcomes and concludes that the evidence is not sufficient [53].

Our findings are consistent with previous review studies. It is well evidenced that common space, goals, leadership, role clarity and transparent processes are critical [46–49], and it has been shown that evidence of impact of these on health outputs and outcomes is insufficient [51]. Moreover, there has been insufficient research on the effects of financial models on primary care [53]. The conceptual justification lies in the challenge of attribution and is a typical challenge in the context of program evaluation and evaluation of health programs [119]. As visualized in the logic model, process outcomes are a direct result of team characteristics, while patient health outcomes are mediated through a causal chain, and are also influenced by other external factors. We know less about the impact on health outcomes, which is justified conceptually, but regrettable, because these are arguably of most interest to policy planners.

Our systematic review has three limitations. First, the analytical framework relies on the quantitative conceptualization of reality into causes and effects. The assumption is made that characteristics of teams contribute to the outputs and outcomes of care. The language (influences and consequences) is used to avoid terminology typically associated with quantitative studies (e.g. cause and effect, or dependent and independent variable). The use of the framework may have resulted in the assignment of some qualitative studies to research questions that were not the primary questions intended by the study authors.

Second, the MMAT rating tool [64] proved relatively challenging to use, and we observed that it may favour qualitative studies, in that criteria for the assignment of the rating are more interpretive. Assignment of MMAT scores by two independent reviewers mitigated this limitation. The relatively high MMAT ratings of 3 or 4 for most studies included here could be the result of an effective peer review process across scholarly journals.

And third, the need to formulate a search syntax required that our study question be narrowed in scope beyond what may have been justified substantively (e.g. by specific health conditions). The focus on some conditions could have resulted in missing some studies that were indexed for conditions that we did not include in our MESH Terms. Furthermore, despite such narrowing, the nature and remaining scope of the review required performing much of the study selection manually. The key terms used by study authors to describe their studies often did not reveal aspect relevant to our study question. The limitation is that much of this review relied on human judgement of a team of researchers and research assistants. While strategies were used to mitigate variations (regular meetings, written protocols, two reviewers to each study at each stage), the replicability of the study is lower than it would be, if we had been able to refine the search syntax more. In other words, the review is only as good as the titles, key terms and abstracts given to studies by their authors, and our success in applying criteria consistently to a large volume of items.

Lastly, two amendments to the study protocol were made during the course of the review: (i) limitation of scope to the four countries and selected years; and (ii) decision about further conditions, beyond the initial four chronic conditions specified in the protocol. The geographic scope reduction did not likely have a large impact on results, given that only 9% of studies from diverse countries were excluded. The time period reduction resulted in a bias in favour of recent experiences. The exclusion of any conditions reduced our ability to speak to primary care in general, however as explained, the nature of studies necessitated this amendment.

5. Conclusion

Our systematic review of academic studies published since the turn of the century reveal that our understanding of how best to design IPPC teams is patchy. Extant evidence paints a relatively clear picture of team characteristics that improve team processes. The implications for health outcomes, however, are less clearly understood.

Publicly funded health systems are committed to the importance of interprofessional teams in primary care. The *Health at a Glance: Europe 2016* report identifies that IPPC teams are the norm in 15 European Union countries, while in the other 13 a trend can be observed of increasing IPPC team practices [120]. A report by the Primary Care Workforce Commission in England calls for a multidisciplinary workforce, in which a collaboration between a general practitioner and a nurse is required and the addition of other health professionals is recommended [121]. This corresponds to the New Zealand Ministry of Health emphasis on multidisciplinary primary are teams [122].

At the same time, broader health system statements identify health outcomes as the ultimate goals. For example, the National Vision for Primary Health Care in Australia envisions a system that is: "*. . .keeping people healthy, preventing illness, reducing the need for hospital services, and improving management of chronic diseases*. . ." [123]. The New Zealand Ministry of Health emphasizes improvement in people's well-being as the ultimate goal [124]. And the countries of the EU ". . .emphasize the need to further develop indicators, increasing indicators focusing on health outcomes. . ." [125].

Given the movement to implement and expand IPPC team care provision across health systems, coupled with the need for a better understanding of the implications for health outcomes, we would benefit from a coordinated effort between researchers and policymakers to design teams and studies of their effects concurrently. This would allow for quasi experimental set-ups and potentially improve evidence of the impacts of IPPC team characteristics on health outcomes. In addition, qualitative work continues to play a critical role in identifying contexts and external influences that contribute to health outcomes.

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Systematic Review Registration

This study protocol for this study was registered in PROSPERO CRD42016041884.

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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.2019.03.015.

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