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**MAAP-PHC** Models and Access Atlas for Primary Care at Providence Health Care

Literature Review

# Patient Complexity in Primary Care

## Grouping Systems with a Special Focus on Validity and Applications in Primary Care Settings

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Completed on 2016-12-31

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## Abstract

**Objectives:** to identify tools to stratify patient complexity and examine the current context in which such tools may be used for planning of future innovations in primary care for British Columbia.

**Methods:** MEDLINE/PubMed and EMBASE were searched in November 2016 to identify studies on patient complexity grouping systems (PCGS) used in primary care setting, their applications to healthcare or defining patient complexity. The search was limited to English studies published between January 2006 to December 2016

**Results:** Out of 7379 articles identified, 97 were reviewed for their abstract or in entirety and 27 PCGS used in primary care setting were identified. Building on six commonly used PCGSs identified by a systematic review published in 2012, a total of eight PCGSs (diagnosis count, medication count, Chronic Disease Score/RxRisk, Charlson Comorbidity Index, Adjusted Clinical Grouping System, Cumulative illness Rating Scale, Duke Severity of Illness Checklist, and Quality and Outcomes Framework Score) validated in primary care setting were reviewed in detail. No PCGSs incorporated patient's psychosocial factors in predicting patient or system-level outcomes. Other than Adjusted Clinical Grouping System used in Canada and US for provider profiling, limited application of PCGS or patient complexity to clinical practice or policy development were identified.

**Conclusion:** All eight measures are of comparable predictive validity, however diagnosis count, Charlson Comorbidity Index and Adjusted Clinical Grouping System have the most research evidence and perform well with any patient or system-level outcomes. Available resources and outcomes of interest should be considered when deciding on PCGSs to use. Development of PCGS incorporating patient's psychosocial factors should be considered. Venues or initiatives to encourage knowledge sharing between the frontline clinicians and policy makers with researchers would facilitate advances in the application of patient complexity in healthcare policy.



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## Introduction

The College of Family Physicians of Canada has proposed the Patient’s Medical Home (PMH) as the future model of family practice in Canada (1). The PMH is composed of ten goals, some of which include 1) personal family physician, 2) timely access, 3) comprehensive care, and 4) continuity of care (1). Such a model of care has been proposed to potentially mitigate the changes anticipated with the aging of the Canadian population and the predicted increase of multi-morbidity and proportion of medically complex patients. A move to the PMH model will require a significant shift in structure of the primary care system in British Columbia (BC).

Previous research has noted that continuous, community-based primary care from a single provider has protective health effects (2,3). However, McGrail et al. have reported that only 24% of family physicians in BC have a high-responsibility practice pattern where they are the most responsible physician to their patients, making necessary referrals, monitoring health conditions over time and modifying treatments (4).

To encourage more family physicians to take up increasing responsibility caring for complex patients, the government of BC introduced a monetary incentive in the form of complexity billing code. However, a recent study by Lavergne et al. reported that the province’s \$240 million investment in complexity billing code “did not appear to improve primary care access or continuity, or constrain resource use elsewhere in the health care system” and encouraged developing alternative initiatives to tackle this issue (5).

Schaink et al. in their scoping review on defining patient complexity noted that chronic conditions can be complex due to multiple factors such as multimorbidity, comorbid mental health conditions, older age, low social capital and the need for heavy healthcare utilization (6). We referred to tools used to measure such patient complexity as patient complexity grouping systems (PCGSs). PCGSs have been used to estimate prevalence of those with multimorbidity (7-13), predict patient or healthcare system-level outcomes (14-36), or factors contributing to/modulating impact of patient complexity (8,37-39).



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This literature review is intended to identify PCGSs used in primary care and examine the current context in which such tools may be used for planning of future innovations in primary care for BC. The review will explore available literature regarding the following:

- 1) Identification of patient complexity grouping systems used in primary care
- 2) An overview of common patient complexity grouping system
- 3) Description of how patient complexity grouping systems have been used in health care and health care billing context, especially in Canada
- 4) Identification of gaps in knowledge

## Methods

The literature search used in this study refers to a structured query of databases to generate a descriptive overview of published literature on PCGSs used in primary care and its applications in health care and health care billing context. Although it is not an attempt to capture comprehensive knowledge on this topic, it aims to capture major published studies. Through our EMBASE and Medline/PubMed database search covering all articles from 2006 onward, we identified a systematic review exploring PCGSs in primary care setting examining all published articles before 2009 (14). As our study is not a systematic review (40), we relied on this study to provide overview of articles published before 2009 rather than examining all articles ourselves. Thus abstract/full text review on articles published before 2009 was not done. Similarly, additional search on each PCGS (step #7) on articles describing PCGS were limited to those published after 2009. However, as Huntley et al. did not examine articles for application of PCGS in healthcare, we examined all articles published until 2016 to identify any articles on this topic.



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## Results

We identified a total of 7379 articles. Through a scan of titles, we identified 97 articles for abstract and/or full text review. Articles were then excluded if PCGSs are not its focus or if the article limits its participants to those who have a specific health condition (eg. diabetes). Full inclusion/exclusion criteria were used to assess for inclusion during abstract and/or full text review. Sixty-four articles were used for this literature review. See the Appendix for the search strategies used and the diagrammatic description of search process.

### Patient Complexity Grouping Systems Available to be Used in Primary Care Setting

Twenty-seven unique PCGSs used in primary setting were identified. See following page for the complete list. A systematic review by Huntley et al. identified multimorbidity measures used in primary care, and chose six [diagnosis count, Chronic Disease Counts (CDC)/RxRisk, Charlson Comorbidity Index (CCI), Adjusted Clinical Groups (ACG), Cumulative illness Rating System (CIRS), Duke Severity of Illness Checklist Index (DUSOI)] that were mentioned in more than five studies to describe further (14). We identified two additional PCGSs [medication count, Quality and Outcomes Framework Score (QOFS)) that were mentioned in more than three studies from our search. The above eight PCGSs are described in more detail in Table 1.

All eight PCGSs focused on measuring multimorbidities. Two of the PCGSs, diagnosis count and medication count, involved count and then adding up individual diagnosis or medication, respectively. The rest were complex measures that required use of an algorithm or a formula to generate a final score (41-46). Some measures account for severity or worse prognosis of some conditions by using a differential weighting scheme (41-43) or by relying on assessor judgment (44,45). Only three PCGSs were specifically designed for primary care setting (43,45,46). Other PCGSs were developed in non-primary care settings but were later validated in primary care population.



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## Complete List of Identified PCGSs

Note: bolded PCGSs are covered in detail in this review

1. **Simple count of medical condition**
2. **Quality and Outcomes Framework**
3. **Charlson comorbidity index**
4. **Count of prescribed drugs**
5. **John Hopkins ACG software**
6. Proprietary Centers for Medicare & Medicaid Services algorithm
7. Higashi score
8. **Cumulative Illness Rating Scale**
9. Commercial risk predictor
10. Estimated physician-defined complexity
11. **Chronic Disease Score/RxRisk-V**
12. **Duke Severity of Illness Checklist**
13. Italian Health Search Morbidity Index
14. Resource-Based Relative Value Scale
15. Geriatric CompleXity of Care Index
16. Medicare Hierarchial Condition Category
17. Multimorbidity Assessment Questionnaire for Primary Care
18. Disease Burden Morbidity Assessment
19. Functional Comorbidity Index
20. Cumulative complexity model
21. Index of co-existing disease
22. Kaplan Scale
23. Geriatrics Index of co-morbidity
24. Elixhauser index
25. Medication-Based Disease Burden Index
26. Count of physician visits
27. Count of hospital claims



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## Optimal Patient Complexity Grouping Systems to be Used in Primary Care Settings

The literature does not present a clear conclusion on which PCGS would be optimal to use in a primary care setting. There are limited studies comparing predictive validity of multiple PCGSs in the same patient population. Summarizing the results of studies comparing different PCGSs is difficult as different studies include different PCGSs for comparison (47). Although there are minor differences in predictive validity, comparison studies generally report predictive validity of PCGSs to be comparable, with simple measures performing just as well as more complex ones (14,19,32,47). However, certain PCGSs perform slightly better when used to predict certain outcomes, and the comparison studies advise selecting PCGSs based on the primary outcome of interest (14,18,19,47). For instance, mortality is best predicted by CCI (14,15,19,48). Healthcare utilization is best predicted by ACG (14,32), CCI (14), diagnosis count (14,15,48), and medication count (19). Healthcare cost is best predicted by ACG (14,32), medication count (15), and diagnosis count (15). Patient functioning/quality of life is best predicted by diagnosis count (14), CCI (14), RxRisk (47).

Another factor to consider when choosing PCGS is availability of resources; ACG is available through subscription only and CIRS and DUSOI require subjective judgment of the assessor, thus mandating assessor training. Simple measures (diagnosis/medication count), while lacking ways to account for difference in disease severity, may be better for scoring accuracy and cost (18). This may be an advantage if to be used in billing context, where repeated assessment of patient complexity may be needed for every budgetary period (18).

In general, studies comparing different PCGSs repeatedly recommended CCI, ACG and diagnosis count because the most research is available on them and these PCGSs have shown consistent validity in predicting a variety of outcomes.

## Application of Patient Complexity Grouping Systems in Primary Healthcare

The majority of studies describing use of PCGSs have been confined to their use in academic settings, where they were used to estimate prevalence of those with multimorbidity (7-13), predict patient or healthcare system-level outcomes (14-36), or factors contributing to/modulating impact





of patient complexity (8,37-39). Limited examples are available where implementation of complexity, or PCGS is used to alter clinical practice (9,49-52). Examples of PCGS being used in healthcare billing is limited. The majority of available publications involve ACG, which has been used in the United States to examine providers for equitable and efficient healthcare provision (53,54). In Canada, ACG has been used to profile physicians to detect inappropriate billing practices (43,55,56).

An example of another PCGS used in American healthcare billing is Hierarchical Conditions Categories (HCC) which was developed using ICD codes to identify patients expected to incur most Medicaid cost (57). To select a PCGS to identify patients with high-risk of resource utilization and to reward practitioners for taking care of these patients, Pope et al. compared HCG with ACG, the chronic disease and disability payment system, clinical risk groups, and the clinically detailed risk information system for cost (58). HCC has been chosen based on its transparency, ease of modification and good clinical coherence to be used in the United States (58).

## Discussion

### Definition of Complexity

Schaink et al. who conducted a scoping review on the definition of patient complexity have defined complexity in three ways: 1) presence of multimorbidity, or having multiple health conditions, 2) extensive healthcare utilization, and 3) presence of psychosocial barriers to accessing optimal care (6). Despite this multi-prong definition of patient complexity, all the PCGSs identified in this study focuses on measuring multimorbidity. More importantly, when used to determine which patients should be considered complex, common PCGSs like CCI only had at most a moderate agreement with the classification done by primary care physicians [PCPs (25)]. This low agreement is concerning if PCGS were to be used in healthcare billing context as a surrogate for clinicians' judgment in identifying complex patients.

The importance of psychosocial factors in patient complexity has been well acknowledged (8,25,26,37). Grant et al. has found that in addition to multimorbidity, PCPs took into consideration the patient's socioeconomic status, behaviors, physical/mental illness to classify someone as



complex (59-61), which may better reflect what a real-life complex patient looks like. In light of the finding by Grant et al., Hong et al. have compared predictive validity between physician-defined complexity and multimorbidity measures like CCI and Commercial Risk Predictor, and found former to be better in predicting future suboptimal care and healthcare utilization (26).

Being able to incorporate this comprehensive definition of patient complexity in healthcare billing would better allow physicians who care for complex patients to be appropriately remunerated. For such incorporation to happen, patient's psychosocial barriers would have to be measurable in a simple, quick to use, reproducible, and inexpensive way. However, currently there is no validated PCGS with such characteristics. Identification of a suitable surrogate measure of patient's psychosocial barriers and/or development of PCGS incorporating such barriers would be valuable in better predicting patient or healthcare system outcomes.

### Application of Patient Complexity Grouping System

Articles identified in this study only include few applications of complexity grouping to clinical practice or healthcare policy. All but one of the limited publications on PCGS's application in healthcare billing involves ACG, most of which takes place in Canada and the United States (43,53,55,56). It is unclear whether this is because the other PCGSs are not used in healthcare billing context, or because such data is not published. Further exploration of unpublished literature, especially in European countries whose healthcare system shares many similarities with Canada, would be valuable to better understand how patient complexity is being used in healthcare billing context. Also, this finding may reflect lack of communication between academia and frontline clinical practice and healthcare policy development. Frontline clinicians and policy makers can benefit from thorough peer evaluation and feedback as well as knowledge exchange from researchers while researchers can benefit from rich real life experience of clinicians and policy makers. Venue or means of facilitating conversation between these stakeholders should be encouraged.

This lack of available literature makes it difficult to compare whether ACG is superior to other PCGS in BC healthcare billing context. Although ACG is reported to have good predictive validity for healthcare utilization and cost (14,18,19,27-36,43), its performance will be limited by the quality of



administrative data it uses as the source. Verhulst et al. have noted potential weakness of the Canadian administrative database, some of which include less specificity in the codes used compared to American counterparts and limited attention historically placed on the accuracy of diagnosis recording (55). Devising a way of addressing such weakness or comparing the performance of ACG against non-administrative database utilizing PCGS using BC billing data would be recommended.

## Limitations

This literature review is not a systematic review, so there are some methodological limitations making it not fully comprehensive. Rather than going through all articles to identify and review all mentioned PCGSs, we relied on a previously published systematic review to identify PCGSs included in articles published before 2009. However, the search strategy we used was different from that used by Huntley et al., so it is very likely that we have missed some relevant articles and PCGS (14). Also, Huntley et al. selected six multimorbidity measures to provide focus overview based on how many articles cited that measure (14). This method is useful in identifying widely used measures but may not identify novel or not well known measures that could be of better predictive validity. However, providing comprehensive review of available literature was not our purpose; we wanted to provide an overview of literature available on PCGS and patient complexity. Our current search strategy has provided us with a sufficient description of literature on this topic and allowed us to identify gaps in knowledge in published literature.

Additionally, conducting a literature search on patient complexity and way to measure it was challenging as there was no clear consensus on how one should define complexity (7,62,63). Subsequently, complexity was not very well indexed within PubMed and Embase. We have identified at least sixteen articles (16% of reviewed articles) that fit our inclusion criteria but were not captured by the search strategy because they did not contain multimorbidity and related keywords. Consensus on the definition of patient complexity and better indexing may benefit from specific academic discussion.

## Conclusion



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Eight commonly used patient complexity grouping systems validated in primary care have been identified (see Box 1) Although all eight are of comparable predictive validity for patient-level (eg. mortality) and healthcare system-level (eg. hospitalization, healthcare cost) outcomes, CCI, ACG and disease counts are recommended as most research are available on them and these PCGSs have shown consistent validity in predicting a variety of outcomes. As all of the above PCGSs are primarily measures of multimorbidity, a measure including psychosocial influencers of patient complexity would be a better predictor of patient and healthcare system outcomes. Little literature was available on how PCGS and patient complexity were used in clinical setting or policy development except on ACG. As such initiatives are unpublished, better collaboration with frontline clinicians and policy makers should occur to facilitate knowledge exchange.

## Acknowledgement

The author would like to thank Dean Giustini and Ursula Ellis from UBC Library with their advice on the literature search, and Dr. Rita McCracken and Kasra Hassani for project design guidance, content review and editing of manuscript.



## Tables and Figures

### Section 1. Overview of Common Patient Complexity Grouping Systems

A. Disease Count	
Description of the PCGS	Simple count of diseases/disease class a person has from a predetermined list of conditions (the list differs across studies), and the count is added up to give a sum
Original Purpose	No paper available describing development of the measure Originally used to measure multimorbidity
Number of Times Used in Identified Articles	<b>Widely used</b> 7 studies in this review (7,14-17,64,65) 98 studies in the systematic review (14)
Use in Canada	Quail et al. use administrative data in Saskatchewan to determine best multimorbidity measures for use in general population, diabetes and osteoporosis cohorts (15).
Application in Healthcare Billing	Not reported
Other Uses	Multimorbidity prevalence measure (7) Predictive validity study of novel measures (64) Prediction of patient and system-level outcomes (14-17)
Other Comments	No gold standard definition of how to use this measure (e.g. what conditions to count, how granular the condition can be)
Additional Resources	Not applicable



## B. Medication Count

Description of the  
PCGS

Simple count of prescription medication class a person has and the count is added up to give a sum

Original Purpose

No paper available describing development of the measure  
Originally used to measure multimorbidity using prescribed medication as proxy

Number of Times  
Used in Identified  
Articles

**Not commonly used**  
3 studies in this review (15,16,19)  
Not included in Huntley et al. (14)

Use in Canada

Quail et al. use administrative data in Saskatchewan to determine best multimorbidity measures for use in general population, diabetes and osteoporosis cohorts (15)

Application in  
Healthcare Billing

Not reported

Other Uses

Prediction of patient and system-level outcomes (15,16,19)

Other Comments

No gold standard definition of how to use this measure

Additional Resources

Not applicable



### C. Adjusted Clinical Grouping (ACG) System

#### Description of the PCGS

Through administrative or insurance database, all medical diagnosis of a person within a defined time period (usually a year) is examined and assigned a ACG, which takes into account aggregated diagnosis groups (a cluster of diagnosis which use similar amount of healthcare resources), age and gender.

#### Original Purpose

No paper available describing development of the measure  
Originally used to measure multimorbidity using prescribed medication as proxy

#### Number of Times Used in Identified Articles

**Widely used**  
18 studies in this review (8,10,14,18,19,27-36,43,55,66)  
25 studies in Huntley et al.(14)

#### Use in Canada

Hanley et al. showed ACG did better than CCI in predicting drug expenditure (35)  
Sibley et al. showed administrative data-based ACG could be used to predict family physician and specialist utilization in Ontario (36)  
Starfield et al. provided a summary of literature on ACG use many of which are Canadian (43)  
- Explaining referral rate variability in Alberta (67)  
- Stratified BC patients based on multimorbidity and examined association with healthcare utilization (68)  
- Physician profiling for outliers in billing in BC (55,56)

#### Application in Healthcare Billing

Uses UK General Practice Research Database to compare different models of capitation system. Reports the model with multimorbidity measure could decrease incentives to select patients who are less sick (18).  
Physician profiling for outliers in billing in BC (43,55,56)  
Use of ACG to profile resource utilization in US VA using different outcome measures (53)  
Examining whether risk adjustment using ACG eliminates incentives for US Managed Care Organization to avoid substance users (54)

#### Other Uses

Multimorbidity prevalence measure (8-10)  
Prediction of patient and system-level outcomes (14,18,19,27-36,43)  
Predicting patient’s healthcare-related choices (43,66)  
Identification of highest risk older patients to treat more intensively (52)



Other Comments

Starfield et al. provide summary of literature on ACG use (43)

Only available with subscription

Developed specifically for predicting healthcare utilization in primary care setting

**Key articles:** (43,55,56)

Additional Resources

More information available through the official website (69) and Starfield et al. who provided the overview of ACG Systems and the summary of its application in the literature





## D. Charlson Comorbidity Index (CCI)

### Description of the PCGS

Each disease from a predetermined list of 19 (3 more disease and 1 medication added for primary care use) is given a weighting of 1 to 6 and weighted scores are summed - this score then can be combined with age (each decade after age 40, score of 1 is added)

### Original Purpose

Originally developed in US medical inpatient population to predict 1-year mortality (42)  
Later validated in USA primary care setting (70)

### Number of Times Used in Identified Articles

#### Widely used

9 studies in this review (14-16,18,19,25,26,35,64)  
38 studies in Huntley et al.(14)

### Use in Canada

Quail et al. use administrative data in Saskatchewan to determine best multimorbidity measures for use in general population, diabetes and osteoporosis cohorts (15)

Hanley et al. showed ACG did better than CCI in predicting drug expenditure (35)

Fortin et al. showed CIRS did better than CCI and Functional Comorbidity Index when the outcome was health-related quality of life using Quebec data (71)

### Application in Healthcare Billing

Uses UK General Practice Research Database to compare different models of capitation system. Reports the model with multimorbidity measure could decrease incentives to select patients who are less sick (18)

### Other Uses

Predictive validity study of novel measures (64)

Prediction of patient and system-level outcomes (14-16,18,19,25,26)

### Other Comments

Multiple version available (eg. one for ICD-10, one for ICD-9)

### Additional Resources

More information available through the official website (72) and the version of the tool validated in primary care can be found in the publication by Charlson et al. (70)



## E. Chronic Disease Score (CDS)/RxRisk Model

### Description of the PCGS

Original CDS considered 17 disease states, weighted by an expert panel  
Score is created based on history of dispensed drugs for 1 year, adjusted for age and sex  
Revised CDS and RxRisk used empirically derived weights and expanded on the number of diseases that can be captured by the tool

### Original Purpose

Originally developed in US adult Health Management Organization enrollees to measure chronic disease status using routine pharmacy data as a proxy of diagnosis (41)  
Revised CDS and RxRisk Model developed to build on the original CDS (73,74)

### Number of Times Used in Identified Articles

**Frequently used**  
10 studies in this review (14-17,20-24,75)  
17 studies in Huntley et al.(14)

### Use in Canada

Quail et al. use administrative data in Saskatchewan to determine best multimorbidity measures for use in general population, diabetes and osteoporosis cohorts (15)

### Application in Healthcare Billing

Not reported

### Other Uses

Predictive validity study of novel measures (75)  
Prediction of patient and system-level outcomes (14-17,20-24)

### Other Comments

Can be automated (76)

### Additional Resources

The original version of the tool can be found in the publication by von Korff et al. (41), subsequent revisions described by Clark et al. (73) and Fishman et al. (74)



## F. Cumulative Illness Rating System (CIRS)

### Description of the PCGS

Each body system has a severity rating of 0 to 4, which are summated to create a total score (0-56), or presented as an index based on the number of categories scoring 2 or more

### Original Purpose

Originally developed in hospitalized men in US to assess the medical burden of chronic illness (44)

Later validated in primary care setting (77)

### Number of Times Used in Identified Articles

#### Frequently used

8 studies in this review (7,11-14,17,78,79)

10 studies in Huntley et al. (14)

### Use in Canada

Validation of CIRS in primary care took place in Quebec (77)

Fortin et al. showed CIRS to be better than CCI or Functional Comorbidity Index when the outcome was health-related quality of life using Quebec data (71)

Fortin et al. reported prevalence of multimorbidity in Quebec family practice (80)

### Application in Healthcare Billing

Not reported

### Other Uses

Multimorbidity prevalence measure (11-13)

Prediction of patient and system-level outcomes (14,17,22)

Predictive validity study of novel measures (79)

Definition of multimorbidity (7)

### Other Comments

Fortin et al. examined construct validity of electronic CIRS and scoring by nurses (78)

Requires subjective assessment for scoring

Majority of studies involves geriatric population.

### Additional Resources

The original version of the tool can be found in the publication by Linn et al. (44)



### G. Duke Severity of Illness Checklist (DUSOI)

Description of the PCGS

Each diagnosis is rated on 4 levels (symptom, complication, prognosis without treatment, prognosis with treatment), various severity scores are calculated using the ratings (from 0 to 4) for each parameter of every diagnosis and combined using the equation listed in the original article to yield a final score

Original Purpose

Originally developed in adult patients in American family practice setting to quantify the burden of illness as measured by the physician (45)

Number of Times Used  
in Identified Articles

**Not commonly used**

1 study in this review (14)

6 studies in Huntley et al. (14)

Use in Canada

Not reported

Application in  
Healthcare Billing

Not reported

Other Uses

Prediction of patient and system-level outcomes (14)

Other Comments

Originally developed for primary care setting

Requires subjective assessment for scoring

International field testing data available (81)

Additional Resources

The original version of the tool can be found in the publication by Parkerson et al. (45)



## H. Quality and Outcomes Framework (QOF) Score

### Description of the PCGS

17 predetermined list of conditions were identified and their Read codes were generated. The number of conditions are added to generate a QOF score.

### Original Purpose

Originally developed in UK patients older than 60 registered in primary care database to develop a standardized morbidity score for low-risk population (46)

### Number of Times Used in Identified Articles

**Not commonly used**

3 studies in this review (8,18,19)

Not included in Huntley et al. (14)

### Use in Canada

Not reported

### Application in Healthcare Billing

Not reported

### Other Uses

Multimorbidity prevalence measure (8)

Prediction of patient and system-level outcomes (18,19)

### Other Comments

Originally developed with primary care population

Quality and Outcomes Framework is being used extensively in UK to incentivize physicians to provide good quality care but no report of QOF score being used for that purpose is available

### Additional Resources

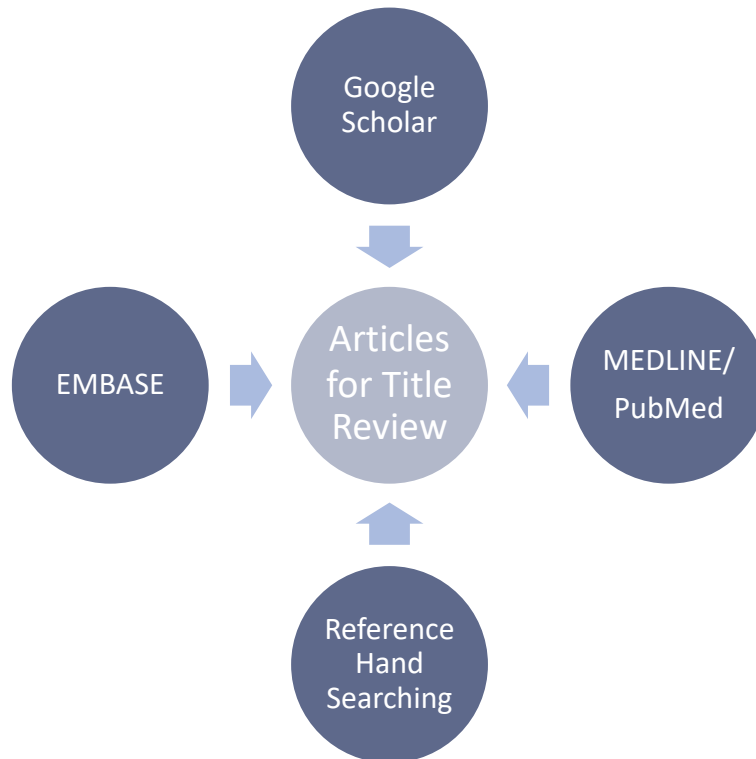
The original version of the tool can be found in the publication by Carey et al. (46)



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## SECTION 2. Description of the Literature Search Process

### Article Sources





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## Search Methodology

This literature review included published articles indexed in:

- 1) Medline/PubMed
- 2) EMBASE
- 3) Google Scholar - for initial search of key articles only

Inclusion criteria were:

- 1) English articles published after 2006, as older articles may be less relevant
- 2) Provides overview of tools classifying patient complexity and describes their property or usage in healthcare setting OR  
Explores how to define patient complexity or provides a specific example where patient complexity was used to alter patient care or healthcare policy
- 3) Considers complexity measures in a primary care setting

Systematic reviews, scoping reviews and Canadian studies were the focus of the search.

Exclusion criteria were:

- 1) Non-English articles
- 2) Published before 2006
- 3) Focus of the article is not on the patient complexity tools, defining patient complexity or its application
- 4) Setting does not include primary care
- 5) Tool focuses only on a single disease (eg. diabetes-specific tool)

Search strategy was as follows:

- 1) Reference list from key articles identified by Google Scholar search examined to identify initial list of relevant articles.
- 2) Key search terms were generated from the initial list.
- 3) Medline/PubMed and EMBASE searched to identify relevant articles for abstract review.
- 4) Key articles from the list were pulled for full text review.
- 5) Relevant articles identified from #4's reference list.

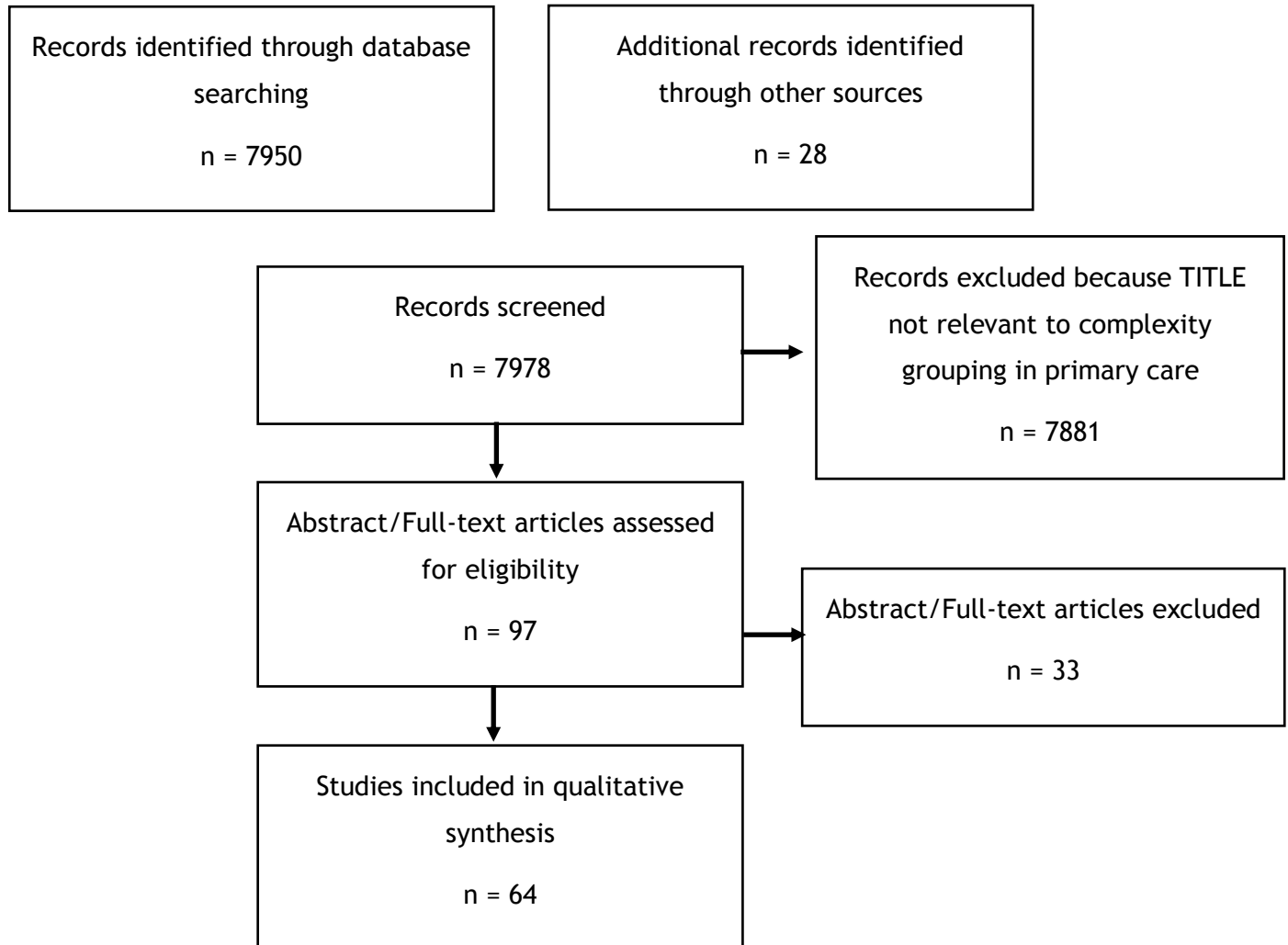


- 6) Six common PCGSs described in detail from Huntley et al. (14) and two additional PCGSs mentioned in more than three studies from our search were identified as common PCGSs used in primary care.
- 7) MEDLINE was searched using each of PCGSs identified in #8 as keyword terms to generate any other articles that may fit inclusion criteria.
- 8) Summary of the findings were synthesized.





## Search Process





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