

The User's Guide To Measuring Comorbidity in COPD: An IPCRG Initiative

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ABOUT THE INITIATIVE

- Comorbidities are common in COPD patients and have a significant impact on patients' quality of life, exacerbation frequency and survival; however, they are often under-recognized and under-treated.
- Numerous tools have been identified in the literature that measure comorbidity in chronic disease; however, health care practitioners have little guidance when measuring comorbid conditions in their COPD patients.
- The *User's Guide* employs a succinct, descriptive approach to summarizing the strengths and weaknesses of **8** carefully selected tools which are commonly used by primary care practitioners to assess comorbidity in their COPD patients.

BACKGROUND

- COPD is a disease with significant mortality, yet the majority of patients with this condition will die from other causes.
- COPD exacerbations and comorbidities contribute to the overall severity in individual patients.
- Approximately three quarters of COPD patients have at least 1 other co-occurring condition.
- Efforts have been made by researchers to provide informative publications that address the current challenges of measuring multimorbidities in patients with chronic disease.
- However, to date, no single contribution provides a comprehensive approach, or practical guide that lists relevant and available tools for measuring multimorbidity in patients with COPD in primary care.

OBJECTIVES

- By condensing the research of key investigators in the field, this *User's Guide* will highlight important information for primary care practitioners.
- By providing a brief yet descriptive snapshot of each of the 8 tools, primary care practitioners will be better placed to make informed decisions. We accomplish this by condensing the descriptive information into three sections:
 - 1) **Standout Feature**;
 - 2) **Key Elements** or "strengths"; and
 - 3) **Potential Limitations** or "weaknesses" of each of the 8 selected measures.
- Furthermore, by presenting the challenges associated with terminological consensus, and measurement design, creation and validation using this particular format, health care practitioners will be better able to select the most appropriate tool for their needs.

METHODS

- A review of the literature to search for tools that measure comorbidity and related terms (e.g., multimorbidity, multiple chronic conditions, multiple co-existing diseases, etc.) in COPD patients was conducted, as well as investigative work of the current research literature was used to inform the descriptive properties of each tool.

SEARCH METHODOLOGY

- **Phase 1** of the project included a targeted literature search in key medial bibliographic databases was conducted between 2000 and the present.
- A concept map of similar and related terms was created and used to refine the search process.
- A master list of all the tools identified in the literature was created.
- Pre-determined inclusion and exclusion criteria were used to evaluate, as well as critically appraise the relevancy of each tool for inclusion in this *Guide*.
- The following inclusion/exclusion criteria was applied:
 - Included a mix of both general and COPD-specific tools
 - Tested and used in primary practice
 - Tested for validity and reliability
 - Practical/easy to administer
 - Costs/conditions of use/availability
 - Responsive
 - Available in other languages
- **Phase 2** of the search and selection process invited members of the IPCRG research committee to participate in a simple survey to help narrow the list and contribute their expertise and commentary (See **Appendix A**).

Evaluation and Results

- A total of 27 comorbidity tools were identified in the literature.
- Of the 27 tools, **8** were selected for the *Guide* (**Appendix B** for a copy of the complete *User's Guide*).
- Both general and disease-specific indices measuring a variety of conditions were considered, and were evaluated independently by two investigators to achieve inter-rater reliability.
- A descriptive table for each of the 8 tools was created, summarizing 17 categories (See **Table 2** below), which highlights: 1) one **Standout Feature**; 2) **Key Elements**; and 3) **Potential Limitations** of each tool.

Table 1: 8 Selected Comorbidity Tools

1	Charlson Comorbidity Index
2	Clinical COPD Questionnaire (CCQ)
3	Self-Administered Comorbidity Questionnaire (ACQ)
4	COPD-Specific Comorbidity Test (COTE) Index
5	Cumulative Index Rating Scale (CIRS)
6	Elixhauser Method
7	Index of Coexistent Diseases (ICED)
8	John Hopkins' Aggregated Diagnosis Groups (ADGs)

Table 2: 17 Descriptive Categories

1	List of modifications	9	Original/ Primary Purpose (for non-disease specific indices)
2	Original/Introductory article or Source	10	Validity/Reliability
3	Supporting articles	11	Costs/Conditions of use
4	Web/Print location/availability	12	Responsive (Yes or No)
5	General vs. Disease-specific	13	Practical/Easy to administer
6	Type (e.g., comorbidity, mulitmorbidity, MCC)	14	Tested in primary practice (Yes or No)
7	Coexisting conditions measured	15	Other languages
8	Setting (acute, ambulatory, primary care, etc.)	16	Summary
9	Original/ Primary Purpose (for non-disease specific indices)	17	Strengths and Weaknesses

IMPLICATIONS

- By condensing the research of key investigators in the field, this *User's Guide* highlights important information for primary care practitioners.
- By providing a brief discussion of each tool, primary care practitioners will be better placed to understand the strengths and weaknesses of each measure, and make informed decisions on the application and relevance of each tool, as it pertains to their primary practice needs.

CONCLUSIONS

- Primary care practitioners and researchers need to recognize and consider the implications of the terminology used to describe patients with multiple co-existing diseases when providing care. For example, instead of focusing solely on patients having COPD as the primary or index disease (i.e., comorbidities), practitioners should adopt a more comprehensive and effective approach whereby the coexistence of 2 or more chronic conditions (i.e., multimorbidities) are considered.
- Numerous tools and measures are available to primary care practitioners, either privately or publicly, as well as general or disease-specific, to help guide practitioners when measuring comorbidity (or multimorbidity) in COPD patients; however, no gold standard approach to measuring comorbidity (or mulitmorbidity) in the context of COPD exists.
- With the help of this comprehensive *User's Guide*, primary care practitioners can gain practical, evidence-based guidance when selecting an appropriate tool for their practice needs, which in turn, will help increase mortality and quality of life of their patients with COPD.

APPENDIX A: Survey

The User's Guide To Measuring Comorbidity in COPD: An IPCRG Initiative

About the Guide

The International Primary Care Respiratory Group (IPCGR) is developing a User's Guide to help primary care physicians better assess comorbidity in patients with COPD.

After a comprehensive review of the literature, the IPCRG team identified 8 tools to measure comorbidity in COPD patients (see attached Table 1). These tools were carefully selected according to predefined inclusion and exclusion criteria, such as: proven validity and reliability; the setting and original population studied during initial development (e.g., acute vs. primary care); general vs. disease-specific measures; and the inclusion of relevant and/or related health conditions identified in the research literature as common comorbid conditions associated with patients with COPD. The team decided to evaluate each tool using a simple, descriptive approach based on a set of categories that are believed to be relevant to the health care practitioners who will likely use the Guide in primary practice.

Why You?

As a member of the IPCRG team, we have invited you to participate in a survey as part of a select group of researchers and/or practitioners, whom we have identified as having specialized skills and experience that will add significant value to our ongoing efforts to design a practical user's guide for primary care physicians committed to offering the best care to their patients living with COPD, in addition to one or more health condition(s).

The Survey

This simple, electronic survey consists of 5 "yes" or "no" questions, as well as the opportunity to comment on the questions asked. You will also be invited to offer suggestions and/or guidance based on your specialized experience, to help further develop the User's Guide. **The survey should take between 5 and 20 minutes to complete.**

We would like to thank you in advance for your time and feedback with this IPCRG project. **Please return the completed, saved survey to Lana Atkinson (acubed@shaw.ca) by Friday, December 5th, 2014.** If you have any questions, please feel free to contact: Dr. Andrew Cave (Andrew.cave@ualberta.ca) or Lana Atkinson (acubed@shaw.ca).

APPENDIX A

The User's Guide To Measuring Comorbidity in COPD: An IPCRG Initiative

Questions	Answers (Yes or No)	Comments
1. Upon review of the attached table, can you identify any additional tools that should be included in the User's Guide that we may have overlooked?		
2. Upon review of the attached table, can you identify any key articles or studies that we may have missed to support our analysis and description?		
3. Do you prefer the newly designed descriptive approach to evaluate the tools, compared to the "smiley faces" approach previously used by IPCRG to rate tools?		
4. Do you agree on the list of categories used to describe each tool?		
5. Do you have any further comments or suggestions?		

Completed by (optional): _____

APPENDIX B: Descriptive Table Of Selected Tools

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Tool	Description
1. Charlson Comorbidity Index	<p>Standout Feature:</p> <ul style="list-style-type: none"> It is the most extensively studied and used measure <p>Key Elements:</p> <ul style="list-style-type: none"> General measure; not COPD or disease-specific Measures 19 coexisting conditions; these conditions were selected and weighted on the basis of the strength of their association with mortality Modified version exists Used in primary care practice Requires patient chart/record review; uses a weighted index; was intended for use with inpatient hospital records Reliability validity is good (de Groot et al, 2003) Charlson et al. (1987) <p>Potential Limitations:</p> <ul style="list-style-type: none"> Requires external validation and calibrating on the data set of interest (Bottle & Aylin., 2011) There “is an underestimation of overall comorbidity resulting from the exclusive use of the Charlson Index” (Almagro et al., 2010, p. 258) This index “fails to show information on conditions that are not included within it, but which in some cases might be more frequent among women with COPD, thereby producing an underestimation of comorbidity among them” (Almagro et al., 2010, p. 254) Does not adjust for function status as an outcome (Sangha et al., 2003, p. 162.)

<p>2. CCQ Clinical COPD Questionnaire</p>	<p>Standout Feature:</p> <ul style="list-style-type: none"> • “Brevity and simplicity makes it particularly more suitable for use in clinical practice” (Sundha et al., 2011, p. 173) <p>Key Elements:</p> <ul style="list-style-type: none"> • COPD or disease-specific • 10 items, with 7 possible responses • Questions assess patients responses from the past week • Copyrighted by T. van der Molen • Freely available at: http://www.biomedcentral.com/content/supplementary/1465-9921-7-62-S1.PDF <p>Potential Limitations:</p> <ul style="list-style-type: none"> • The number of potential comorbidities is limited
<p>3. SCQ Self-Administered Comorbidity Questionnaire</p>	<p>Standout Feature:</p> <ul style="list-style-type: none"> • Inexpensive, practical alternative to chart review; and is particularly useful in settings where medical records are unavailable <p>Key Elements:</p> <ul style="list-style-type: none"> • Modified version of the original Comorbidity Questionnaire (Sangha et al., 2003) • This simple measure identifies 13 specific, common “problems” or conditions, which progress through a series of 3 stages, which the patient provides “yes” or “no” answers for, in order to determine if treatment has been received, and if the associated problem(s) limit daily activities • Also provides opportunities for patients to list any “other medical problems” not listed in the initial list of 13 problems • Includes indices of disease activity, physical function, health-related quality of life (HRQoL) and work disability • Correlation with the Charlson Index was “moderately strong” (Sangha et al., 2003, p. 162). • Available at: Sangha O, et al. (2003) • Includes index disease in analysis, since the creators felt that “it would not be possible for individuals to separate index from coexisting diseases, particularly by questionnaire” (Sangha et al., 2003, p. 162) <p>Potential Limitations:</p> <ul style="list-style-type: none"> • Not disease or COPD-specific • Available data provide only initial and preliminary support for validity • Studies inpatients exclusively; further studies are needed to assess the performance of the measure in

	<p>outpatients.</p> <ul style="list-style-type: none"> This measure “represents an efficient method to assess comorbid conditions in clinical and health services research” (Sangha et al., 2003), but not necessarily in clinical practice settings
<p>4. COTE Index COPD-specific CO-morbidity TEst</p>	<p>Standout Feature:</p> <ul style="list-style-type: none"> This measure identifies 12 common comorbidities in COPD patients that negatively influence survival, including conditions such as: atrial fibrillation, pulmonary fibrosis or anxiety, which are otherwise not included in the Charlson Index (Divo et al., 2012, p. 14; Stolz et al. 2014) <p>Key Elements:</p> <ul style="list-style-type: none"> COPD or disease-specific Intended to predict mortality (or improve the prognostic accuracy of mortality) when added to the already validated BODE Index among patients with COPD This simple measure uses a points scale index (similar to the Charlson Index) in the range of 1 to 6, and is assigned to each selected comorbidity in proportion to its hazard ratio (HR) Increases in the COTE Index is associated with an increased risk of death from both COPD and non-COPD related causes (Divo et al., 2012, p. 10) Can help predict which patients with COPD are at increased risk of death, regardless of their baseline physiological state (Divo et al., 2012, p.11) Available at: Divo M, et al. (2012) <p>Potential Limitations:</p> <ul style="list-style-type: none"> This measure does not actively identify cognitive dysfunction; however, evidence shows that it is “associated with increased mortality and disability and is unrecognized in 50% of patients with COPD” (Dodd & Jones, 2012) Results from the initial study included few women in the cohort; not by design, but because of the nature of the type of patients attending the clinics where the study was conducted Findings may not apply to all patients with COPD since the patients included in the study were recruited from specialty clinics (e.g., cancer or diabetes clinics).
<p>5. CIRS Cumulative Index Rating Scale</p>	<p>Standout Feature:</p> <ul style="list-style-type: none"> This measure is “structured according to clinically relevant body systems and uses a clear severity ranking system that is clinically sound” (de Groot et al., 2003, p. 227) <p>Key Elements:</p> <ul style="list-style-type: none"> Intended to assess the medical burden of chronic illness

	<ul style="list-style-type: none"> • This measure addresses all relevant body systems without using specific diagnoses • Uses a 5-point scale • Rates 14 body system domains (or organ systems) and provides a severity score for each domain, conceptually valid (i.e., supporting content validity) • Developed originally for hospitalized men in the United States and subsequently older, geriatric adults in ambulatory settings • Criterion validity has been confirmed; however, little evidence is available to support predictive validity; interrater and test-retest reliability are good (de Groot et al., 2003, p. 225) • Free access • Information to assess comorbidity can be obtained during clinical consultations or from medical records <p>Potential Limitations:</p> <ul style="list-style-type: none"> • Single diagnoses are not specified (Diederichs et al., 2011, p. 307) • Required a trained assessor to fill our form
<p>6. Elixhauser Method Elixhauser Comorbidity Measure</p>	<p>Standout Feature:</p> <ul style="list-style-type: none"> • Updated for use with the ICD-10 diagnosis classification scheme (Austin et al., 2012) <p>Key Elements:</p> <ul style="list-style-type: none"> • Originally developed to predict mortality in patients with multiple conditions • Non-proprietary and can be used without payment <p>Potential Limitations:</p> <ul style="list-style-type: none"> • Requires external validation and calibrating on the data set of interest (Bottle & Aylin, 2011) • Intended for use with inpatient hospital records
<p>7. ICED Index of Coexistent Diseases</p>	<p>Standout Feature:</p> <ul style="list-style-type: none"> • All information contained in a medical chart can be used to calculate a score (de Groot et al., 2003, p. 226) <p>Key Elements:</p> <ul style="list-style-type: none"> • General measure; not COPD or disease-specific • Consists of two types: one measuring disease severity of 19 medical conditions (ICED-DS), and one measuring the “overall functional severity” of 11 physical impairment scores (disability) caused by comorbidity (ICED-FS) • Scores are based on an explicit list of symptoms, signs, and laboratory tests • Data support concurrent and predictive validity; intrarater reliability is good, and interrater reliability is fair

	<p>(de Groot et al., 2003, p. 226)</p> <ul style="list-style-type: none"> Originally “developed to predict in-hospital postoperative complications and 1-year health-related quality of life of patients who underwent total hip replacement surgery” (Zekry et al., 2010, p. 1036) <p>Potential Limitations:</p> <ul style="list-style-type: none"> Calculating ICED score can be somewhat complicated; it is determined by an algorithm that combines peak scores for the IDS and IPD Requires medical records and highly trained reviewers who must follow complex decision rules (Zekry et al., 2010, p. 1036)
<p>8. ADGs John Hopkins’ Aggregated Diagnosis Groups</p>	<p>Standout Feature:</p> <ul style="list-style-type: none"> Unlike the Charlson and Elixhauser Comorbidity classification schemes, the ADG definitions do not rely solely on the use of inpatient health administrative data, but also on the use of ambulatory health care data as well (Austin et al., 2012) <p>Key Elements:</p> <ul style="list-style-type: none"> Person-focused, diagnose-based method of categorizing persons’ illnesses and to predict mortality Intended for use with both in-patient and out-patient (ambulatory) patient records Originally developed to help predict health care resource utilization The ADG system assigns each ICD code to 1 of 32 diagnosis clusters known as <i>Aggregated Diagnosis Groups</i> or ADGs Individual diseases or conditions are placed into a single ADG based on five clinical dimensions: 1) Durations; 2) Severity; 3) Diagnostic certainty; 4) Etiology; and 5) Specialty care involvement <p>Potential Limitations:</p> <ul style="list-style-type: none"> This measure is limited by its complexity and data requirements relative to other tools “ADGs [also] requires a user license, which typically requires a fee (although this may be nominal when used for research or academic purposes)” (Austin et al., 2012, p. 886)

REFERENCES

Austin PC, Stanbrook MB, Anderson GM, Newman A, Gershon AS. Comparative ability of comorbidity classification methods for administrative data to predict outcomes in patients with chronic obstructive pulmonary disease. *Ann Epidemiol* 2012;22:881-7.

Almagro P, Lopez Garcia F, Cabrera FJ, Montero L, Morchon D, Diez J, Soriano JB. Comorbidity and gender-related differences in patients hospitalized for COPD. The ECCO study. *Respir Med* 2010;104:253-259.

Bottle A, Aylin P. Comorbidity scores for administrative data benefited from adaptation to local coding and diagnostic practices. *J Clin Epidemiol* 2011;64:1426-1433.

Carey IM, Shah SM, Harris T, DeWilde S, Cook DG. A new simple primary care morbidity score predicted mortality and better explains between practice variations than the Charlson Index. *J Clin Epidemiol* 2013;66:436-44.

Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987;40:373e83.

de Groot V, Beckerman H, Lankhorst GJ, Bouter LM. How to measure comorbidity. A critical review of available methods. *J Clin Epidemiol* 2003;56:221-9.

Diederichs C, Berger K, Bartels DB. The measurement of multiple chronic diseases--a systematic review on existing multimorbidity indices. *Journals of Gerontology Series A-Biological Sciences & Medical Sciences* 2011;66:301-11.

Divo M, Cote C, Torres JP, Casanova C, Marin JM, Pinto-Plata V, Zulueta J, Cabrera C, Zagaceta J, Hunningshake G, Celli B, BODE Collaborative Group. Comorbidities and risk of mortality in patients with Chronic Obstructive Pulmonary Disease. *Am J of Resp Crit Care Med* 2012;186:155-61.

Dodd JW, Jones PW. Potential limitation of the COTE index in assessing the impact of comorbidities on mortality in chronic obstructive pulmonary disease. *Am J Resp Crit Care Med* 2012; 186: 804-5.

Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. *Med Care* 1998;36:8e27.

Goodman RA, Posner SF, Huang ES, Parekh AK, Koh HK. Defining and measuring chronic conditions: imperatives for research, policy, program and practice. *Prev Chron Dis* 2013;10:E66.

- Hall SF. A user's guide to selecting a comorbidity index for clinical research. *J of Clin Epidemiol* 2006;59:849-855.
- Hillas G, Perlikos F, Tsiligianni I, Tzanakis N. Managing comorbidities in COPD. *Int J Chron Obstruct Pulmon Dis* 2015;10:95-109.
- Huntly AL, Johnson R, Purdy S, et al. Measures of multimorbidity and morbidity burden for use in primary care and community settings: a systematic review and guide. *Ann Fam Med* 2012;10:134-41.
- The John Hopkins University ACG case-mix system. Available at: <http://www.acg.jhsph.org/>. Accessed November 2, 2014.
- Marengoni A, Angleman S, Melis R, Mangialasche F, Karp A, Garmen A, Meinow B, Fratiglioni L. Aging with multimorbidity: a systematic review of the literature. *Aging Research Reviews* 2011;10:430-9.
- Miłkowska-Dymanowska J, Białas AJ, Zalewska-Janowska A, Górski P, Piotrowski WJ. Underrecognized comorbidities of chronic obstructive pulmonary disease. *Int J Chron Obstruct Pulmon Dis* 2015;10:1331-1341.
- Sangha O, Stucki G, Liang MH, Fossel AH, Katz JN. The Self-Administered Comorbidity Questionnaire: a new method to assess comorbidity for clinical and health services research. *Arthritis Rheum* 2003;49:156-63.
- Sarfati D. Review of methods used to measure comorbidity in cancer populations: no gold standard exists. *J Clin Epidemiol* 2012;65:924-33.
- Sharabiani MT, Aylin P, Bottle A. Systematic review of comorbidity indices for administrative data. *Medical Care* 2012;50:1109-18.
- Smith MC & Wroble JP. Epidemiology and clinical impact of major comorbidities in patients with COPD. *Int J Chron Obstruct Pulmon Dis* 2014;9:871-888.
- Stolwijk KC, van Tuberge A, et al. Aspects of validity of the self-administered co-morbidity questionnaire (SCQ) in patients with ankylosing spondylitis. *Rheumatology* 2014;53:1054-64.
- Stolz D, Louis R, et al. COPD-specific co-morbidity test (COTE) for predicting mortality in COPD – Results of an European, multicenter study. *European Respiratory Journal* 2014;44. Available at: http://erj.ersjournals.com/content/44/Suppl_58/P566
- Tsiligianni IG, Kosman E, van der Molen T, Tzanakis N. Managing comorbidities in COPD: a difficult task. *Current Drug Targets* 2013;14:158-76.

Valderas JM, Starfield B, Sibbald B, Salisbury C, Roland M. Defining comorbidity: implications for understanding health and health services. *Ann Fam Med* 2009;7:357-63.

Zekry D, Loures Valle BH, Lardi C, Graf C, Michel JP, Gold G, Krause KH, Hermann FR. Geriatrics index of comorbidity was the most accurate predictor of death in geriatric hospital among six comorbidity scores. *J Clin Epidemiol* 2010;63:1036-44.