PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Association between frailty, chronic conditions and socio-economic status in community-dwelling older adults attending primary care: A cross-sectional study using practice-based research network data
AUTHORS	Mangin, Dee; Lawson, Jennifer; Risdon, Cathy; Siu, Henry; Packer, Tamar; Wong, Sabrina T.; Howard, Michelle

VERSION 1 – REVIEW

REVIEWER	Green, Richard University of Surrey, School of Health Sciences
REVIEW RETURNED	26-Sep-2022

GENERAL COMMENTS	I thank you for an interesting and enlightening paper. I found the design of this study to be an excellent use of existing datasets, providing useful information that will be valuable to clinicians and healthcare planners, among many others. I have some comments to address in this paper, primarily concerning clarity of expression and ensuring comprehension of meaning, and some other comments that you may wish to consider for this paper or may wish to consider for future work - I leave these to your discretion to consider in combination with other feedback you receive, as I fully appreciate the course you have taken and propose these with justifications but also considerations of the caveats that accompany these. General Comments - Is there some signposting or short further explanation that can be done for the reader's better understanding of the ICD9 codes, particularly concerning how broad or specific some of these codes might be. For instance, unipolar depression is a common code across all frailty groups, but could this code extend to conditions like anxiety. How broad can the coding be. - On Page 11, line 19 you write the following: Physicians were asked to complete frailty assessments (selecting a CFS score between 1-9) of patients whom they felt confident that they could assess based on their overall knowledge of the patient. There were no specific exclusion criteria. Scored lists were collected from each provider and securely entered within a research database, replacing all patient identifiers with the MUSIC patient ID. Scores were completed for 77% of eligible patients. My understanding from this is that frailty assessments were done from memory by the family physician of patient, rather than the family physician conducting the frailty assessment upon seeing this patient by arrangement in person. If I am incorrect in my understanding, I think more clarity is needed. If I am incorrect, I

would suggest recognising this more explicitly as a limitation of the study at the start, and discuss a bit more near the end of the paper. You state that 77% of possible people were given a frailty score, but we don't have a sense of how accurate these scores are and CFS is validated for use in a certain way- presuming use of the tool with the patient present for the consultation (according to my understanding). I think this needs to at least be acknowledged as a limitation- I don't know if other studies have adopted similar approaches and can demonstrate efficacy of such an approach.
- I am a little unclear on the latter part of this sentence:
The number of chronic conditions (disorders and risk factors) were grouped as 0, 1, 2-4, 5+ and categorized having 1 or more conditions versus none.
When you say categorised do you mean in terms of a binary split? If so, if the measure is multimorbidity then should it be 0 or 1 vs 2+?
- Pg 17. line 13-- it should be 2-4 not 2-3 for conditions, I think.

Considerations for Future Work

- You state that you cannot draw conclusions around causation frailty and socioeconomic, which is entirely fair. However, I wonder whether the Canadian census offers the possibility to link neighbourhood data backwards in time to previous census' and whether that could provide evidence of stable socioeconomic and/or material deprivation data that could be used in combination with cohorts of patients with health histories who have remained in the same geographic area for extended periods, which might offer some evidence pertaining to causality. Undoubtedly a tall order but your design is great evidence to show what might be possible with good data available. Your work also highlights the importance of having data about socioeconomic inequity for the provision of primary care, and while allueded to it would be a welcome addition to see this raised more explicitly in your discussion or conclusion, if you saw fit to do so.
- I have been given to understand that the step between a CFS score of 6 to a score of 7 can change quickly and present challenges for patients, family carers, and care professionals. Future analyses may benefit from including CFS score of 6 in the high frailty category, rather than the medium frailty category, which would increase the patient numbers high frailty, reduce a skew from older and more multimorbid patients, and provide a greater understanding of borderline severely frail population.

REVIEWER	Beilby, Justin National Health and Medical Research Council of Australia Centre of Research Excellence Frailty Trans-disciplinary Research To Achieve Healthy Ageing, Torrens University
REVIEW RETURNED	12-Oct-2022

GENERAL COMMENTS	This is a good solid paper. The use of the MUSIC network and a 77% completion rate of using the Clinical Frailty Scale by participating GPs does provide a solid foundation. My main question to the authors is so where now? I really think the authors should add a final section re next steps if they were tackling this complex issue within the network. Reporting this data is the first step only. Some more specific comments include: Abstract In the conclusion - how would you operationalise a health equity approach,? This needs another sentence Introduction

	Primary care does play a role - but how ? could we add another sentence at the end of the first paragraph?
	Methods
	no real comment other than to complement the authors on the 77% completion of scores. How did they achieve this? Any training? Incentives?
	Results
	The results and the attached tables are well presented. The trends and associations are challenging and in some ways expected.
	Discussion
	I have talked above re the need to answer the question - what next? I would suggest that the authors consider commenting on what is occurring locally within their network, across their region and then across primary care/general practice in Canada.

REVIEWER	Ching Wong, Arkers
	The Hong Kong Polytechnic University, School of Nursing
REVIEW RETURNED	13-Oct-2022

GENERAL COMMENTS	Thanks for inviting me to review this paper. The flow is clear and easy-to-read. However, I have some concerns related to the content of the manuscript.
	1. From the literature search, I have found a lot of similar studies measuring the association among frailty, chronic conditions, and socioeconomic status. What make this manuscript so special? The authors didn't mention this in the introduction. In addition, how about the results of similar studies? What is the impact/ significance of doing this?
	2. Any exclusion criteria?
	3. Did the authors do the adjusted and unadjusted analyses and why? Why use ANOVA? How to handle missing data? Why not sperate each factor into one model?
	4. May the authors add a demographic table?
	5. What was the "new" thing found in this study?
	6. What was the suggestion of the change of service by the authors after knowing the result?

VERSION 1 – AUTHOR RESPONSE

General Comments

- Is there some signposting or short further explanation that can be done for the reader's better understanding of the ICD9 codes, particularly concerning how broad or specific some of these codes might be. For instance, unipolar depression is a common code across all frailty groups, but could this code extend to conditions like anxiety. How broad can the coding be.

We have added more details to the second paragraph of Cohort Creation (page 11-12) to provide more clarity around ICD9 codes. Here is some further explanation as well. ICD9 codes are arranged in a branched, hierarchical structure where there are both conceptually broad codes at the top of

branches to represent broader disease categories and in lower tiers there are more specific disease instances. As a classification system rather than a terminology there is not always strict logic in the groupings. In the case of Depression (unipolar) the ICD9 term name of that code (311) is *Depressive disorder, not elsewhere classified*. In our EMR system we renamed that term with clinician friendly naming for greater clarity and in this case to signal to physicians coding this condition that it was not to be used for bipolar depression that has the separate code 296. This work can be referenced here: https://pubmed.ncbi.nlm.nih.gov/32716304/ As stated on page 10/11.

We additionally applied our own grouping method for condition codes considered to be similar (i.e., variations of the same base condition) for example, Dementia (ICD9 290) and Alzheimers (ICD9 331.0) to form meaningful groups for frequency analysis. We did not group depression and anxiety together though as these we consider these disorders to be clinical different.

On Page 11, line 19 you write the following:

Physicians were asked to complete frailty assessments (selecting a CFS score between 1-9) of patients whom they felt confident that they could assess based on their overall knowledge of the patient. There were no specific exclusion criteria. Scored lists were collected from each provider and securely entered within a research database, replacing all patient identifiers with the MUSIC patient ID. Scores were completed for 77% of eligible patients.

My understanding from this is that frailty assessments were done from memory by the family physician of patient, rather than the family physician conducting the frailty assessment upon seeing this patient by arrangement in person. If I am incorrect in my understanding, I think more clarity is needed.

You are correct in this interpretation of the method. The patient lists generated for the physicians to score were limited to patients who had a recent clinical encounter (within approximately 3-6 months of time of scoring) which we thought to be an appropriate window for reasonable recall of the patient's frailty status to make for accurate scoring.

(If I am incorrect, I would suggest recognising this more explicitly as a limitation of the study at the start and discuss a bit more near the end of the paper.)

The interpretation was correct, so we have not added this as a limitation.

You state that 77% of possible people were given a frailty score, but we don't have a sense of how accurate these scores are and CFS is validated for use in a certain way- presuming use of the tool with the patient present for the consultation (according to my understanding). I think this needs to at least be acknowledged as a limitation- I don't know if other studies have adopted similar approaches and can demonstrate efficacy of such an approach.

The CFS scoring instrument has been validated in a variety of healthcare settings including primary care and the Thandi paper referenced in our paper. The CFS validation requirements states that the patients do not need to be see in person to form an accurate score. We have added more detail about this to the paper to clarify for the reader (see Frailty Score assignment on page 10).

- I am a little unclear on the latter part of this sentence:
The number of chronic conditions (disorders and risk factors) were grouped as 0, 1, 2-4, 5+ and categorized having 1 or more conditions versus none.
When you say categorised do you mean in terms of a binary split? If so, if the measure is multimorbidity then should it be 0 or 1 vs 2+?

Yes, we analysed this in two ways. As you are implying, multimorbidity would typically report on 2+ or 3+ conditions. We examined chronic conditions (disorders and risk factors) in
two ways: firstly, dichotomising as having 1 or more conditions versus none and then a more detailed breakdown analysing the 1+ grouping as those having just 1 condition, or 2-4 or 5+. In Table 1 these values appear under the header Multimorbidity (see table below) but we could change the heading to Chronic Conditions if more appropriate to be more accurate.

We have added this detail within the section Data Analysis on page 13, to be clearer in the paper for readers

-Pg 17. Line 13—it should be 2-4 not 2-3 for conditions, I think.
Yes, thank you for pointing that out. It has been corrected in the manuscript.

Considerations for Future Work

- You state that you cannot draw conclusions around causation frailty and socioeconomic, which is

entirely fair. However, I wonder whether the Canadian census offers the possibility to link

neighbourhood data backwards in time to previous census' and whether that could provide evidence

of stable socioeconomic and/or material deprivation data that could be used in combination with

cohorts of patients with health histories who have remained in the same geographic area for extended

periods, which might offer some evidence pertaining to causality. Undoubtedly a tall order but your

design is great evidence to show what might be possible with good data available.

This is an interesting idea, and we would have loved to be able to do this, but yes, it is out of reach for

us for this study. We are working on improving this data in Canadian PBRN datasets so hopefully

future analyses will allow this kind of linkage.

Your work also highlights the importance of having data about socioeconomic inequity for the

provision of primary care, and while alluded to it would be a welcome addition to see this raised more

explicitly in your discussion or conclusion, if you saw fit to do so.

We have added a statement in the Discussion (on page 21-22) and within the Conclusion of the

Abstract that calls for socioeconomic data and ideally patient-level socioeconomic data to be

systematically collected and combined with frailty markers and chronic disease coding to alert

clinicians and quality specialists working in clinics to those patients at risk for poor prognoses.

- I have been given to understand that the step between a CFS score of 6 to a score of 7 can change quickly and present challenges for patients, family carers, and care professionals. Future analyses may benefit from including CFS score of 6 in the high frailty category, rather than the medium frailty category, which would increase the patient numbers high frailty, reduce a skew from older and more multimorbid patients, and provide a greater understanding of borderline severely frail population.

We agree that categorization of scores 6,7, 8, and 9 would improve the distribution of patients across the categories and based on the data in this analysis we will look at that alternative grouping in future work.

Reviewer: 2

Prof. Justin Beilby, National Health and Medical Research Council of Australia Centre of Research Excellence Frailty Trans-disciplinary Research To Achieve Healthy Ageing, Torrens University Australia

Comments to the Author:

This is a good solid paper. The use of the MUSIC network and a 77% completion rate of using the Clinical Frailty Scale by participating GPs does provide a solid foundation. My main question to the authors is so where now? I really think the authors should add a final section re next steps if they were tackling this complex issue within the network. Reporting this data is the first step only.

Thank you for your positive comments. We have considered next steps and added a concrete example of how these data were used immediately after the study to take a health equity approach to COVID care (see Discussion page 21). Further, we have
added the following statements to Discussion (page 21-22) and witin the Conclusion and the Abstract's conclusion.

The high uptake of CFS coding shows that frailty measures could become routine data points that are scored regularly and recorded within the EMR. Future work should also be directed at systematically and standardly collecting and integrating, as a first step, neighbourhood level SES data available from census data, and then ideally moving to patient level SES data within the primary care EMR. SES, frailty, and chronic disease markers could be automatically combined within the EMR to identify

patients at risk of a poor prognosis. Patient level EMR flags or practice level dashboard could alert providers or quality specialists, respectively, to the need for interventions for addressing social and clinical risk factors for these patients, and to allow program development within clinics of larger groupings to direct resources to those with greatest need.

Some more specific comments include:

Abstract

In the conclusion - how would you operationalise a health equity approach?   This needs another sentence

We have adjusted the Abstract's conclusion to suggest ways to operationalize a health equity:

This study demonstrates the utility and feasibility of collecting frailty data within primary care and the triple disadvantage of disease burden, frailty, and socioeconomic disadvantage. Frailty care needs a health equity approach: systematically collected, patient-level data can relate social risk factors, frailty, and chronic disease toward flagging patients with the greatest need and creating targeted interventions.

Introduction

Primary care does play a role - but how?   could we add another sentence at the end of the first paragraph?

This is a good suggestion thank you - We have adjusted the statement to provide indication of how and cited the evidence for this within the first paragraph of the Introduction (page 7).

Methods

no real comment other than to complement the authors on the 77% completion of scores. How did they achieve this?   Any training? Incentives?

We have explained what we attribute the high scoring completion rate to with this statement in the Methods section Frailty Score Assignment on page 11. We attribute the high scoring completion rate

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on a combination of factors: clinicians were engaged prior to deciding to go forward with the study, the study aligned with physicians' interests in supporting frail patients as well as effective leadership and clinical championing of this study and its data collection requirements.

Results

The results and the attached tables are well presented. The trends and associations are challenging and in some ways expected.

Discussion

I have talked above re the need to answer the question - what next? I would suggest that the authors consider commenting on what is occurring locally within their network, across their region and then across primary care/general practice in Canada.

We agree this would strengthen the paper. We have provided a closing statement in the discussion that describes a data driven approach to signalling high risk patients to providers and quality improvement specialists, for improving the prognosis of high-risk patients. We have also provided an example of how these data were immediately and (serendipitously useful in targeting COVID care immediately after the study.

Reviewer: 3

Dr. Arkers Ching Wong, The Hong Kong Polytechnic University

Comments to the Author:

Thanks for inviting me to review this paper. The flow is clear and easy-to-read. However, I have some concerns related to the content of the manuscript.

1. From the literature search, I have found a lot of similar studies measuring the association among frailty, chronic conditions, and socioeconomic status. What make this manuscript so special? The authors didn't mention this in the introduction. In addition, how about the results of similar studies? What is the impact/ significance of doing this?

Thank you for this observation – we have added a statement (last sentence within the Introduction) to indicate what this study uniquely contributes. We updated our literature search to look for more recent

2. Any exclusion criteria?

3. Did the authors do the adjusted and unadjusted analyses and why? Why use ANOVA? How

to handle missing data? Why not separate each factor into one model?

4. May the authors add a demographic table?

5. What was the "new" thing found in this study?

6. What was the suggestion of the change of service by the authors after knowing the result?

REVIEWER	Beilby, Justin National Health and Medical Research Council of Australia Centre of Research Excellence Frailty Trans-disciplinary Research To Achieve Healthy Ageing, Torrens University
REVIEW RETURNED	15-Jan-2023

GENERAL COMMENTS	I read and reviewed this updated version. I believe the authors have appropriately incorporated the suggested changes. I am in agreement with this version.