

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	The causal impact of social care, public health and healthcare expenditure on mortality in England: cross-sectional evidence for 2013/14
AUTHORS	Martin, Stephen; Longo, Francesco; Lomas, James; Claxton, Karl

VERSION 1 – REVIEW

REVIEWER	Bradley, Elizabeth Yale University, Vassar College
REVIEW RETURNED	10-Dec-2020

GENERAL COMMENTS	<p>The topic of the paper is important, but the impact can be strengthened substantially with some substantial editing.</p> <ol style="list-style-type: none">1. For this audience, the instrumental variable gymnastics should be kept to a minimum and placed in the appendix.2. Similarly, the results need to be selected...pick the results you think are MOST important and defensible and put the rest in the appendix.3. More discussion of the difference between health care spending and social care spending seems important, and how did you deal with the fact that those two are related to each other significantly? Did you think about using the ratio of health-to-social care spending, as Bradley and Taylor have? Surprised not to see their work cited.4. Surprised not to see David Stuckler's work cited
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REVIEWER	Watkins, Johnathan PILAR Research and Education, Cambridge
REVIEW RETURNED	30-Dec-2020

GENERAL COMMENTS	<p>This is an important and interesting study that validates previous work on this with a rigorous methodology and additional data consideration (public health data). The structure of the paper is a bit atypical (e.g. the Methods spans multiple sections and the Results are more process-driven than content-driven), however, on the whole, it is extremely well written and clear to follow.</p> <p>Some minor suggestions below.</p> <p>GENERAL Suggest either adding a study limitation that the elasticities determined for 2013/14 may not hold in other years or validating whether they do by looking at them for 2014/15 or 2015/16.</p> <p>ABSTRACT</p>
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	<p>Suggest changing the Methods section for increased clarity to (additions in upper case): "The impact of social care, healthcare and public health expenditure on mortality is analysed by applying the two-stage least squares method to local authority data for 2013/14. NEXT, we compare the growth in healthcare and social care expenditure pre- and post-2010. We use the difference between these growth rates and the responsiveness of mortality to changes in expenditure TAKEN FROM THE 2013/14 CROSS-SECTIONAL ANALYSIS to estimate the additional mortality generated by post-2010 spending constraints.""</p> <p>STRENGTHS AND LIMITATIONS "Cross-sectional analysis of the impact of social care expenditure on mortality with controls for the level of healthcare and public health expenditure." I am not sure i understand why social care being highlighted here with healthcare and public health expenditure highlighted as controls.</p> <p>I understand that for simplicity's sake often easier to illustrate with one variable rather than all three at once (e.g. Figure 1) so could just say social care is used as an example throughout. Otherwise, I presume social care is not meant to be have more of a focus than the other two variables?</p> <p>INTRODUCTION Suggest changing passage here to : "However, we are not aware of any English studies of the JOINT impact of social care, healthcare and public health on mortality - this study therefore represents first such estimates of the influence of these factors.""</p> <p>METHODOLOGY Using the simple equation without instrumental variables at the start of section 3, was a test for endogeneity performed?</p> <p>DISCUSSION Where it is mentioned that "the public health elasticities are not included in the excess deaths calculations" - should point out at this junction that this is because time series data for public health was unavailable before 2013/14 (I realise it is mentioned later on but would help to note it at this point).</p> <p>Should add as a limitation that primary care and specialised commissioning (the morbidities e.g. cancers covered in this spending bucket contribute a lot to mortality in aggregate) are not included. Therefore, if somehow the centralised commissioning for this leads to unequal provision of services across the country, this could have an unaccounted-for effect on the relationship between local spending and mortality.</p> <p>CONCLUDING REMARKS Suggest emphasising the policy implications of this: social care spending in absolute terms produces better ROI for mortality since as mentioned in Discussion, 1% rise in healthcare expenditure is 4x more than the equivalent rise for social care</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Dr. Elizabeth Bradley, Yale University

Comments to the Author:

The topic of the paper is important, but the impact can be strengthened substantially with some substantial editing.

Authors' response: Thank-you for acknowledging that the topic is an important one. In some places we have edited the paper as you suggest but in others we have persevered with the original presentation for the reasons outlined below.

1. For this audience, the instrumental variable gymnastics should be kept to a minimum and placed in the appendix.

Authors' response: Thank-you for making us think again about how we present the instrumental variable material. We believe a primary contribution of our study is to identify the causal impact of healthcare-related expenditure on mortality. With this information policymakers will be in a better position to make informed decisions about the consequences of their budgetary changes. If we are to be able to comment on the causal effect of expenditure on outcomes then we need to use an appropriate statistical technique such as IV estimation. We believe that we do need to explain to the reader how we are able to go beyond observed association and, in particular, how we address the issue of reverse causality (that is, that current expenditure may reflect past mortality). Moreover, we do need to say something about our instruments because these are referenced in the results section. However, we do agree that unnecessary gymnastics should be avoided. So, with this in mind, we have revised the paper to try to achieve a balance by retaining the material explaining the need for and the use of instruments for healthcare-related expenditure but we have moved all of the discussion about the validity of the selected instruments to an appendix.

2. Similarly, the results need to be selected...pick the results you think are MOST important and defensible and put the rest in the appendix.

Authors' response: We have given this suggestion considerable thought and we agree that it would be preferable if, instead of both backward and forward selection results, we could present just a single preferred set. However, it is not possible to confidently identify the preferred specification and defend the selection of one set of results over the other. In these circumstances we think, on balance, that it is better to present the reader with both sets of results and for them to understand that there is some uncertainty about the size of the causal effects that is not adequately captured by traditional confidence intervals. In this way the reader can see the impact of selecting one set of results rather than another. Moreover, by presenting both sets of results and the process behind them, the reader can see that there is good evidence that healthcare-related expenditure has a significant causal effect on mortality even with a different approach to covariate selection. For these reasons we believe it is important to retain them in the main text as they strengthen the broad findings by [i] demonstrating how we have selected the covariates and instruments in the final two preferred specifications (which helps avoid any criticism of cherry-picking preferred results) and [ii] that, broadly speaking, the results are not sensitive to the choice of specification and covariate selection method.

3a. More discussion of the difference between health care spending and social care spending seems important, and how did you deal with the fact that those two are related to each other significantly?

Authors' response: In England there is a clear distinction between health care and adult social care allocations and spending as they reflect different budgets allocated by central government to different public bodies. One of the contributions of this work is to start to inform these public bodies and central government about a range of decisions on the scale and allocation of public expenditure. In the study year, local health care budgets were allocated to 212 Clinical Commissioning Groups (CCGs) and social care was the responsibility of 152 local government authorities. The

responsibilities assigned to each of these two groups are well defined and section 2 of our paper outlines the sort of activity funded by their budgets. For example, healthcare budgets covered inpatient, outpatient and pharmaceutical expenditure, and social care met assistance with routine daily activities such as washing, dressing, cooking and shopping. We readily acknowledge that this distinction might be less clear in other health and social care systems without a single payer(s) and that, when studying such systems, it would be important to allow for this inter-relationship and how that might interact with policy choice. However, in England this is not the case and hence the issue of inter-relatedness is of far less significance when estimating the total causal effect of each type of public expenditure on mortality.

3b. Did you think about using the ratio of health-to-social care spending, as Bradley and Taylor have? Surprised not to see their work cited.

Authors' response: We were aware of the impressive body of work by Bradley and Taylor (BT) but their work has a very different focus to ours and this makes comparisons difficult for several reasons.

First, their definition of social service spending in 'Variation in health outcomes: the role of spending on social services, public health and health care, 2000-09' is very different to ours. They define social service spending as any public spending on services that have been shown to be associated with health outcomes. This includes expenditure on: education; income support; transportation; the environment; public safety (including police and fire protection); and housing. Our definition of social care spending excludes all of this expenditure. Moreover, one important component of social care spending in the UK is long-term residential/nursing home care but, as we understand it, this type of expenditure is sometimes covered by Medicaid and is therefore included in BT's definition of healthcare expenditure. Hence although we and BT use the same words and apparently study the same variables, our definitions of healthcare and social service/care are so different that meaningful comparisons are extremely difficult.

Second, and closely related to the definitions issue, the BT study has a major focus on the social determinants of health. We agree that these are important but our focus is rather different: we want to examine the causal impact of public healthcare and social care spending on mortality having controlled for social determinants. The reason for this focus is that UK public expenditure has prioritised healthcare over social care but our results suggest that the latter is as important for mortality as the former. Potential reasons for this are outlined in the paper (eg poorer social care provision leads to bed blocking/delayed discharge from hospital). The effects that we have identified reflect the total effect of healthcare and social care on mortality. Future work will attempt to distinguish between the direct and indirect effects of such expenditure.

Third, because their definition of social service spending was necessarily broad, it was not possible to estimate the effect of healthcare and social service expenditure in the same model (due to multicollinearity issues). Instead, BT attempted to overcome this problem by using the ratio of social care to healthcare expenditure. With much the more clearly defined definitions for both types of expenditure in our data, which are the ones most relevant to policy questions in the UK, we have been able to avoid this issue entirely and are able to include both types of expenditure in our health outcome equation.

Nevertheless, this reviewer's comment did prompt us to consider how we might help the reader understand our particular contribution in the context of this larger body of work. For this reason, we have added a paragraph to the introduction and this cites the paper by Bradley et al (2016).

4. Surprised not to see David Stuckler's work cited.

We were aware that David Stuckler has produced an impressive body of work on the political economy of global health and the impact of economic crises on health generally across Europe.

However, our main focus is on the joint estimation of a health outcome equation that includes social care, public health and healthcare expenditure. We were not aware of a contribution from David to this literature. However, we have recently come across a piece he co-authored with Rachel Loopstra and others that relates well to our work and hence we now cite this study in the introduction.

Loopstra, R., McKee, M., Katikireddi, S. V, Taylor-Robinson, D., Barr, B. and Stuckler, D. (2016). Austerity and old-age mortality in England: a longitudinal cross-local area analysis, 2007–2013. *Journal of the Royal Society of Medicine*, 109(3), 109-116. DOI: 10.1177/0141076816632215.

Reviewer: 2

Dr. Johnathan Watkins, PILAR Research and Education, Cambridge

Comments to the Author:

This is an important and interesting study that validates previous work on this with a rigorous methodology and additional data consideration (public health data).

Authors' response: Thank-you for your kind comments.

The structure of the paper is a bit atypical (e.g. the Methods spans multiple sections and the Results are more process-driven than content-driven), however, on the whole, it is extremely well written and clear to follow.

Authors' response: Again, many thanks for your kind comments. Initial drafts of the paper had a long 'Methods' section but in the interests of clarity we thought it preferable to split it into its two constituent parts and so we now have 'Methods: The estimating equation and the selection of instruments for expenditure' as section 3 and 'Methods: Estimation approach' as section 4. The 'Results' section includes a process-driven element because we feel it important to demonstrate to the reader how we arrived at our preferred specifications (one using backward selection and other using forward selection). By including details of the process we feel that it helps to avoid the criticism that we have cherry-picked our preferred results and, by including both sets of results, the reader can see that the precise result depends on which approach to covariate selection is adopted. Nevertheless, on re-reading the initial submission we noted that the presentation of some of the results had slipped into the beginning of the 'Discussion' section and this material has now been moved back into the 'Results' section.

Some minor suggestions below.

GENERAL

Suggest either adding a study limitation that the elasticities determined for 2013/14 may not hold in other years or validating whether they do by looking at them for 2014/15 or 2015/16.

Authors' response: As suggested we have added a study limitation that the elasticities determined for 2013/14 may not hold in other years.

ABSTRACT

Suggest changing the Methods section for increased clarity to (additions in upper case):

"The impact of social care, healthcare and public health expenditure on mortality is analysed by applying the two-stage least squares method to local authority data for 2013/14. NEXT, we compare the growth in healthcare and social care expenditure pre- and post-2010. We use the difference between these growth rates and the responsiveness of mortality to changes in expenditure TAKEN FROM THE 2013/14 CROSS-SECTIONAL ANALYSIS to estimate the additional mortality generated by post-2010 spending constraints."

Authors' response: Thanks for this suggestion. We have changed the text as recommended.

STRENGTHS AND LIMITATIONS

"Cross-sectional analysis of the impact of social care expenditure on mortality with controls for the level of healthcare and public health expenditure."

I am not sure I understand why social care being highlighted here with healthcare and public health expenditure highlighted as controls.

Authors' response: Thanks for highlighting this. We did this to emphasise the impact of social care expenditure on mortality but, on reflection, we have changed the text so that this emphasis is removed.

I understand that for simplicity's sake often easier to illustrate with one variable rather than all three at once (e.g. Figure 1) so could just say social care is used as an example throughout.

Authors' response: Yes, text has been added to make it explicit that Figure 1 could also be applied to healthcare and public health expenditure.

Otherwise, I presume social care is not meant to be have more of a focus than the other two variables?

Authors' response: Yes, this is now the case.

INTRODUCTION

Suggest changing passage here to: "However, we are not aware of any English studies of the JOINT impact of social care, healthcare and public health on mortality - this study therefore represents first such estimates of the influence of these factors."

Authors' response: Text changed as suggested.

METHODOLOGY

Using the simple equation without instrumental variables at the start of section 3, was a test for endogeneity performed?

Authors' response: Yes. The endogeneity test statistics are reported in tables 2 and 3, and we have added some text towards the end of section 4 to draw the reader's attention to this.

DISCUSSION

Where it is mentioned that "the public health elasticities are not included in the excess deaths calculations" should point out at this junction that this is because time series data for public health was unavailable before 2013/14 (I realise it is mentioned later on but would help to note it at this point).

Authors' response: Yes, thank you for pointing out this omission. This has been corrected.

Should add as a limitation that primary care and specialised commissioning (the morbidities e.g. cancers covered in this spending bucket contribute a lot to mortality in aggregate) are not included. Therefore, if somehow the centralised commissioning for this leads to unequal provision of services across the country, this could have an unaccounted-for effect on the relationship between local spending and mortality.

Authors' response: Yes, thank you for highlighting this possibility. It has been added as a potential limitation of the study.

CONCLUDING REMARKS

Suggest emphasising the policy implications of this: social care spending in absolute terms produces better ROI for mortality since as mentioned in Discussion, 1% rise in healthcare expenditure is 4x more than the equivalent rise for social care

Authors' response: Yes, we have added words to this effect to the conclusion, both in the abstract and the main text.

VERSION 2 – REVIEW

REVIEWER	Bradley, Elizabeth Yale University, Vassar College
REVIEW RETURNED	31-May-2021

GENERAL COMMENTS	<p>The paper is very interesting and a very tough research topic to tackle. I commend the authors. I have a few comments to help strengthen the paper, which does still require a statistical review.</p> <ol style="list-style-type: none">1. Define the services in social services. I think you are not counting housing, food, income support, etc., which are really also social services. I doubt in the NHS, you have these costs so I think that needs to be addressed as a weakness, and whatever you are including in social care needs to be very clearly stated.2. Where are long-term care services counted? And do the results change if those are counted as social services or health care services?3. I did not know what instruments “sparsity and input price” for social services meant. Please clarify.4. A limitation (which perhaps instruments address) is that health care and social care expenditures may be co-dependent. To fit the budget envelop of taxation, if an area spends more on health care, it means less for social care and public health—and the variables are all on the right-hand side. Do the instruments address this?
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REVIEWER	Watkins, Johnathan PILAR Research and Education, Cambridge
REVIEW RETURNED	25-May-2021

GENERAL COMMENTS	<p>The authors have addressed all concerns adequately. Moreover, the restructuring with consignment of some of the details around methodology to the Appendix has made it more accessible to the general medical reader.</p>
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VERSION 2 – AUTHOR RESPONSE

Reviewer: 2

Dr. Johnathan Watkins, PILAR Research and Education, Cambridge

Comments to the Author:

The authors have addressed all concerns adequately. Moreover, the restructuring with consignment of some of the details around methodology to the Appendix has made it more accessible to the general medical reader.

Authors' response: Thank-you for your kind comments.

Reviewer: 1

Dr. Elizabeth Bradley, Yale University

Comments to the Author:

The paper is very interesting and a very tough research topic to tackle. I commend the authors. I have a few comments to help strengthen the paper, which does still require a statistical review.

Authors' response: Thank-you for your kind comments.

1. Define the services in social services. I think you are not counting housing, food, income support, etc., which are really also social services. I doubt in the NHS, you have these costs so I think that needs to be addressed as a weakness, and whatever you are including in social care needs to be very clearly stated.

Authors' response: Thank-you for prompting us to clarify this issue. We have added a clear statement of the services that are (and are not) considered to be social care services in England at the beginning of section 2.

"In England, social care expenditure funds residential and nursing home placements, social care in the community to aid daily living, short-term care (e.g. vision rehabilitation and other reablement services to improve independence), equipment and domestic adaptations, and information provision. Public spending on other services addressing the social determinants of health (such as housing, income support, sanitation, transport, etc) is not included in our measure of social care expenditure."

We agree with the reviewer that the social determinants of health (SDH) are important but our focus is rather different: we want to examine the causal impact of public healthcare and social care spending on mortality having controlled for the social determinants. The reason for this focus is that UK public policy has prioritised healthcare over social care but our results suggest that the latter is as important for mortality as the former. Potential reasons for this are already established in the literature and we outline these in the paper (eg poorer social care provision leads to bed blocking/delayed discharge from hospital). Our results question the policy rationale for protecting the healthcare budget but simultaneously not shielding social care services.

2. Where are long-term care services counted? And do the results change if those are counted as social services or health care services?

Authors' response: In England publicly-funded long-term care services are the responsibility of the social service department in each local authority. If long-term care services were the responsibility of healthcare commissioners then we would include expenditure on this item in the total healthcare spend. But in England there is a clear distinction between healthcare and social care allocations/spending as they reflect different budgets allocated by central government to different public bodies with very different responsibilities. And as long-term care is the responsibility of social services, and we want to examine the relative causal effects of changes in the healthcare and social service budgets, adding long-term care expenditure to the healthcare total would not be that meaningful.

3. I did not know what instruments "sparsity and input price" for social services meant. Please clarify.

Authors' response: Thank-you for prompting us to clarify this issue. We have added a brief explanation for both of these so that the relevant sentence in section 3 now reads as: The relative needs formula for the older people's social care included a basic amount per client with top-ups for age, deprivation, low income, low population density (because this increases service delivery costs) and local input prices (in some areas, such as London, labour costs will be higher than elsewhere).

4. A limitation (which perhaps instruments address) is that health care and social care expenditures may be co-dependent. To fit the budget envelop of taxation, if an area spends more on health care, it means less for social care and public health—and the variables are all on the right-hand side. Do the instruments address this?

Authors' response: In England the potential for this co-dependency is very limited because the budgets for healthcare and public health are set centrally and independently of each other, and are

ringfenced for specific healthcare and public health activities. Local authority income comes largely from a central government grant and local taxation. The adult social care budget, which comes out of local authority income, is set locally and, again, this budget is used for specific social care activities that do not overlap with healthcare and public health. And, as the reviewer suggests, the instruments assist with this potential issue because the instruments used for social care expenditure (such as the type of local authority) reflect local attitudes/priorities (such as the innate local culture) which are quite independent of the instruments used to predict central government allocation decisions (such as the distance of the actual healthcare allocation from the target allocation). In a different system, where all revenue is raised locally and all expenditure is determined locally, then there would indeed be co-dependency issues but this was not the situation in England in the study year.

09 July 2021