Author’s response to reviews

Title: Chronic morbidity, deprivation and primary medical care spending in England in 2015-16: a cross-sectional spatial analysis

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Version: 1 Date: 27 Oct 2017

Author’s response to reviews:

We would like to thank both reviewers for taking the time to evaluate our work. The original comments and our point-by-point responses are detailed below. Any resulting changes in the paper have been highlighted to facilitate the review process.

Reviewer #1

This study is an incremental improvement to our understanding of the relationship between morbidity, deprivation and primary medical care spending. It could be improved with significant revisions.

1. p5 ll8-9, missing text: "In addition, the formula used in GMS contracts does not directly adjust for patient deprivation and the measure of morbidity is based on health data derived from the 1998-2000 Health Survey for England,[18] rather than the Since the introduction of the QOF in 2004, annually updated prevalence data..."

Response: Apologies for this oversight. It has now been corrected to read as it should:

“…rather than routinely available up-to-date data.”
Introduction

2. The authors could have mentioned more of the primary care policy background aimed at reducing inequity e.g. abandonment of the Minimum Practice Income Guarantee and the square root transformation of QOF prevalence payments. They should also have noted the GP recruitment difficulties in deprived areas which prevent resources being delivered on the basis of need even if they are allocated.

Response: These are very good suggestions and we have now re-drafted and expanded the introduction to discuss these issues and the limitations of the GMS contract further, as well as providing more detail on the mechanisms of practice funding in the UK:

"In an attempt to address this, in the early 2000s the UK government pursued a range of interventions intended to improve equity and reformed the method of funding primary care practices. A new national General Medical Services (GMS) contract for general practitioners was introduced in 2004, with two main funding components. Core funding for essential and key additional services was calculated using the Carr-Hill global sum formula,[1, 2] based on the number of registered patients, adjusted for patient factors (including age, sex, turnover, morbidity and mortality) and the local context (staff market forces and rurality). This core funding was supplemented by a new pay-for-performance programme – the Quality and Outcomes Framework (QOF) – introduced with the aim of increasing overall funding for primary care and reducing variation in quality between providers.[3] QOF payments were dependent on practice performance against over 100 quality targets relating to practice organisation, patient experience, and clinical management of chronic conditions. Payments for clinical targets were adjusted according the relative prevalence of the relevant condition in the practice population. Further investment in primary care was targeted at deprived areas in 2007 and 2008,[4] with the aim of supporting local efforts to tackle chronic disease and increasing physician numbers in areas where physician recruitment and healthcare delivery can be challenging.[5]

For several reasons these initiatives did not fully address the inequitable distribution of resources and its contribution towards the perpetuation of health inequalities.[6] First, funding under the QOF programme initially favoured larger practices in more affluent areas, which tended to perform better against the quality targets.[7, 8] Gaps in performance rapidly narrowed, [7, 9] although there was no clear evidence for improvement in patient outcomes,[10] or impact on mortality over the longer term.[11, 12] Second, payment adjustments intended to protect practice incomes had unintended consequences. For the clinical QOF targets, relative prevalence was calculated on the basis of the square root of disease prevalence rather than prevalence itself, and practices with low disease prevalence - below the 5th percentile - were treated as if prevalence was equal to the 5th percentile. These adjustments were intended to retain parity between practices with respect to quality payments, but had the effect of uncoupling the relationship between workload and remuneration, disadvantaging practices with high disease prevalence..."
which were more likely to be located in deprived areas. For this reason, from 2009 onwards the prevalence adjustment was calculated on the basis of actual prevalence. Third, the global sum formula for core funding does not directly adjust for patient deprivation and uses a measure of morbidity based on Standardised Limited Long-Standing Illness (SLLI) data derived from the 1998-2000 Health Survey for England.[1] There are long-standing concerns that this formula does not fully reflect the pressures and costs that deprivation imposes on practices.[13] In response to these concerns, under the 2004 contract practices received a Minimum Practice Income Guarantee (MPIG); a ‘correction’ payment to prevent their core funding, based on the new global sum formula, falling below historical levels. MPIG began to be phased out in 2014 with aim of equalizing weighted funding per patient across all practices by 2021.[13, 14] This has left many practices in deprived areas facing financial hardship and urgently calling for a fairer system of resource allocation.[14] NHS England, NHS Employers and the British Medical Association are committed to revising the Carr-Hill formula to better reflect deprivation,[2, 15] but agreement on a new system of allocation has yet to be reached."

Methods

3. The methods are adequate, as far as they go, in terms of the objectives. The funding totals used are appropriate. The authors have chosen to map general practice data to resident populations (LSOAs). There is no methodological problem with this, but if the objective is to describe practice funding and disease burden, a practice-based analysis, with Census data mapped to practice instead, would have been more useful to policymakers. Practice populations can be depicted in maps e.g. in Arc-GIS as colour-coded points based on postcodes of surgeries. On the other hand, they quote a recent study (Levene et al) which used practice as the level of analysis and which explained less variation, so perhaps their decision to analyse a lower level is justified.

Response: This is a valid point: there are advantages to a practice level analysis over our approach, and we were already discussing these in the “strengths and limitations” section. On balance we feel our approach is justified as it allows for the use of the index of multiple deprivation (IMD) at that low geography level. IMD has been shown, unsurprisingly, to be by far the strongest predictor of mortality, and so for addressing the issue of equitable primary care funding, we felt that focusing on the areas served by general practices rather than on the general practices themselves was appropriate. Although the funding is eventually made available at the Clinical Commissioning Group (CCG) level, a low geographical level investigation allows a reliable assessment of the associations of interest: an analysis at the CCG level would not be informative since it would aggregate quite heterogeneous areas.

With respect to relevance to policy-makers, all the data we used are routinely available NHS derived data. These can be used to improve on existing approaches towards more equitable
funding at the practice or CCG level, in exactly the same way a practice-level analysis would work.

4. Since this is a spatial analysis the authors could have moved on for Moran's I to use geographically-weighted regression e.g. using GWR software, rather than classical or ordinary least squares regression, which might have improved model fit, which could have been tested using the Akaike Information Criterion or Hosmer Lemeshow tests. This is a limitation of their analysis, but it would require a major review and should not prevent publication.

Response: Geographically-weighted regression would add another dimension to this work, but we do not think it could replace any of the analyses we presented. Our key question was the (overall) association between need and funding in England and within each of 10 regions. The OLS regression can address that and allows us to weight for the LSOA size, which we think should be the primary consideration in the analysis (i.e. the number of people served within each location). Unfortunately, we are not aware of spatial models that can account for that. Our second aim was to quantify spatial clustering, and we think that was achieved satisfactorily using Moran’s I – the standard statistics for doing this. The approach suggested by the reviewer would quantify whether the relationship between need and funding is “constant” across all data points or varies by region (i.e. if there are geographical clusters where this relationship is stronger/weaker). This interesting area of enquiry was not the primary focus of this study, but we may address this issue in the future.

5. They could also have included GP resourcing in their models to explore the importance of their distribution (see above), and analysed PMS and GMS practices separately (they note that PMS contracts are not visibly adjusted to account for health need). As acknowledged in the Discussion, they did not take into account unmet need i.e. undiagnosed disease; estimates of expected disease prevalence are available on the Public Health England website: https://fingertips.phe.org.uk/profile/prevalence. These are significant and important but not major additional revisions.

Response: We agree that the potential influence of contract type is of interest, but it was not central to our research questions in this study. Nevertheless, this is another good point and one which we will aim to address in future work. Unmet need is an important limitation, which is very difficult to address. The dataset suggested by the reviewer is interesting, but we do not think it includes a reliable proxy of expected (unmeasured) disease prevalence. It includes data from various sources (including the QOF) and modelled estimates, but is limited to a third (7) of all the conditions we have aggregated. From a practical point of view we would not know which of
the estimates to use, while our approach is at least consistent with the use of QOF estimates (on which substantial primary care funding is based) across all conditions.

6. Results: in general these are presented well. Figure 2 and 3 should be supplemented with another map showing the CMI/funding ratio. Figure 5 loses a great deal of information from the local Moran's I, which could have been shown as a map of z-scores at LSOA level, with four categories: high value next to high value etc. There would also be a benefit to show CCG- (or LA-) level autocorrelation. These are significant and important but not major additional revisions.

Response: Thank you for this suggestion. We very much like the ratio idea and have produced a new exhibit (Figure 4) presenting this information. As we now discuss in the text, this figure clearly shows that the North East, North West and London are outliers. With respect to presentation of Moran’s I, we assume that the reviewer is suggesting providing a Moran’s I estimate for each LSOA only taking into account a fixed number of LSOAs (say 10 or 20) around that region, and plotting these estimates on a spatial map. This is another good suggestion, and we will consider it for future use. However, in relation to our primary research question (whether spatial auto-correlation exists and if it varies across English regions) we feel that our current approach is sufficient and possibly preferable, even though we agree that the resulting graph is less elegant.

7. Discussion: good discussion of strengths and limitations. There is insufficient discussion of the policy implications. For example, the authors could have recommended specific changes to the funding formula.

Response: Thank you for bringing this to our attention. Our key recommendation was the need for the use of routinely collected prevalence data to better match need to resources through the formula. We stopped short of making suggestions for direct changes to the formula since that requires a detailed technical analysis and consultation with stakeholders, which would be beyond the scope of the paper. We have, however, expanded the recommendation sections of the discussion to emphasise the need to properly account for deprivation in any future formula:

[Conclusions]

“To meet societal goals of providing equitable healthcare, funding for primary care systems must be distributed according to need, fully accounting for the impact of deprivation.”
Reviewer #2

1. The objectives, methods and conclusions of the paper are coherent and relevant for publication.

The authors have identified high variation in primary care funding in England and that more equitable resource allocation could be achieved if this funding is adjusted considering the chronic morbidity burden. They also have adequately acknowledged the limitations arising from the number of chronic conditions included in the dataset and the structure of the dataset that does not allow to consider the effect of multimorbidity.

Response: Thank you for your positive assessment

2. The authors should consider the inclusion of policy implications/recommendations section and expanding it in a way relevant for policy-makers and healthcare managers outside the UK. The bibliography is rather limited and should be expanded including similar studies in other European countries (particularly with NHS-like health systems) that have analysed the effects of adjusting for morbidity burden and/or social deprivation in large datasets developed for allocation of funding, risk stratification or predictive modeling.

Response: Thank you for this point, which is relevant to point #7 raised by reviewer #1. Our main argument is that up-to-date routinely collected data on prevalence are easily obtained in modern healthcare systems and they should be used for resource allocation. We have not addressed the details of how this would be implemented, as that requires a separate technical analysis and full consultation with stakeholders (including patients, providers, administrators and software suppliers) and is therefore beyond the scope of this paper. We now allude to the need for further work on developing next generation allocation formulae in the discussion:

“More optimal resource utilisation in primary care in the UK is required,[16] and better use of the wealth of information resources already available could help to achieve this aim through the design of fairer resource allocation formulae.”

With respect to international comparisons, we acknowledge that the paper is very much UK-centric but we could not identify equivalent research for other countries with universal healthcare systems – which we think makes this work particularly novel. We have included an additional comment in the discussion about the potential for adapting our research to other contexts:

“Similar information is also routinely collected in other developed countries, and the methods we have described can be highly relevant, both in identifying disease clusters or underdiagnosis, and in matching resources to need. Findings from such analyses can be used in countries that use public sector allocation mechanisms, whether central (e.g. Ireland, Spain) or devolved (e.g. Denmark, Sweden), to directly inform resource allocation. In countries with insurance-based
mechanisms (e.g. France, Germany, Netherlands) analyses can be used to identify mismatches between allocation and need which may require government intervention through risk equalisation schemes,[17] or alternative mechanisms. This will require difficult decisions about the fundamental aims of resource allocation and – within a limited health budget – a commitment to tackling oversupply as well as undersupply.[18]”

Additional changes

We have included an additional limitation in the discussion:

“Fourth, our analysis is dependent on accurate diagnosis and recording of conditions within primary care. There is a danger that any future system of resource allocation based on practice registers would incentivise practices to inflate these registers.”

References


