ARTICLE DETAILS

TITLE (PROVISIONAL) An observational cross-sectional study of the association of poor broadband provision with demographic and health outcomes: The Wolverhampton Digital ENablement (WODEN) Programme

AUTHORS Philp, Fraser; Faux-Nightingale, Alice; Bateman, James; Clark, Heather; Johnson, Oliver; Klaire, Vijay; Nevill, Alan; Parry, Emma; Warren, Kate; Pandyan, Anand; Singh, Baldev

VERSION 1 – REVIEW

REVIEWER Andrikopoulou, Elisavet
University of Portsmouth Faculty of Technology, School of Computing

REVIEW RETURNED 28-Jun-2022

GENERAL COMMENTS The title is huge, very complicated. Consider rephrasing it. Maybe something like:
An observational cross-sectional study of the association of poor broadband provision with demographic and health outcomes
It would be great if you included 1-2 sentences about the background (half your title could go there) in the abstract to give some context.
"Since the digital transformation of health care is inevitable" I thought this is a fact now after covid NHS England's policies discuss digitalisation of healthcare for the past 12 years.
Paper would benefit from some proofreading especially in cases and sentences.
I am not sure how you collected your data and how did you include/exclude. For example when you say all patients do you mean minors too?
How did you go about people that leave together in one household? I assume they have 1 broadband both of them did you duplicate the broadband entry in the database or did you include one person per household?
Do you assume that if there is broadband in a household then all people living there have access? If so why do you make (or not making) such assumption? This can be a major limitation.
How did you merge the two databases?
This is a novel area that can potential have a high impact.

REVIEWER Mitsutake, Seigo
Tokyo Metropolitan Institute of Gerontology

REVIEW RETURNED 05-Jul-2022

GENERAL COMMENTS Miner comments
I can confirm the statistical method added to examine the association of various independent variables with poor or least BII.

In the statistical method section, please add the sentence on how to categorize the IMD and age groups.

Though the authors added "……and 2) variables of deprivation; the two health outcome variables of long-term condition multimorbidity…", the model of step 2 in table 2 included "comorbidities present", not "multimorbidity". Please confirm and revise this confusion.

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<tr>
<th>Reviewer: 1</th>
<th>Authors response</th>
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<td>The title is huge, very complicated. Consider rephrasing it. Maybe something like: An observational cross-sectional study of the association of poor broadband provision with demographic and health outcomes</td>
<td>The title has been amended to reflect the reviewer’s suggestion. It now reads An observational cross-sectional study of the association of poor broadband provision with demographic and health outcomes: The Wolverhampton Digital ENablement (WODEN) Programme</td>
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<td>If agreeable to the reviewer we would prefer to keep the name of our initiative in the study title.</td>
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<td>It would be great if you included 1-2 sentences about the background (half your title could go there) in the abstract to give some context.</td>
<td>The suggested changes made by the reviewer have now been included in the abstract which reads “Objectives The association between impaired digital provision, access and health outcomes has not been systematically studied. The Wolverhampton Digital ENablement (WODEN) Programme is a multi-agency collaborative approach to determine and address digital factors that may impact on health and social care in a single deprived multi ethnic health economy. The objective of this study is to determine the association between measurable broadband provision and demographic and health outcomes in a defined population”</td>
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<td>“Since the digital transformation of health care is inevitable” I thought this is a fact now after covid NHS England’s policies discuss digitalisation of healthcare for the past 12 years.</td>
<td>The authors acknowledge the point made by the reviewer and have amended this to “There is a need to ensure that service users are not excluded as a result of historical, current and future strategies which will drive digital transformations to health care”</td>
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<td>Paper would benefit from some proofreading especially in cases and sentences.</td>
<td>We thank the reviewer for their comments and have now completed a second proofreading of the paper. We hope that no further issues regarding proofreading remain but trust that these will be identified in the typesetting prior to publication.</td>
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<td>I am not sure how you collected your data and how did you include/exclude. How did you merge the two databases? How did you go about people that leave together in one household? I assume they have 1 broadband both of them did you duplicate the broadband entry in the database or did you include one person per household? Do you assume that if there is broadband in a household then all people living there have access? If so why do you make (or not making) such assumption? This can be a major limitation.</td>
<td>Thank you for allowing us to clarify our methods. This was a secondary analysis of two existing datasets and we have provided further information in the manuscript. The datasets (as discussed below) were merged on postcodes which were a common to both and to which LLSOAS map. As stated in the paper Methods -&gt; Data -&gt; “…a single dataset was developed by merging the Point Topic Broadband Digital Exclusion and the Wolverhampton Integrated Health Care databases using post codes to which local authority area codes for the Lower Layer Super Output Areas (LLSOAs) are mapped.” Repeated in Results -&gt; “The datasets were linked on locality codes” Methods -&gt; Population studied – “All patients (including children and young adults) registered with a Wolverhampton General Practitioner (GP) and those who were residents known to have had any hospital contact. “ The only stage at which any exclusion occurred was during the statistical analysis and we have made this explicit. Statistical method -&gt; “The regression analysis was undertaken on 250,609 residents as 19,176 were exclude by missing or unclassifiable ethnicity coding.” Regarding the reviewer’s points about broadband in a house and multiple people, which is also linked to components of BII and IMD: We have provided an additional reference for the Lower Layer Super Output Areas (LLSOAs) and as per the definition in the paper Data -&gt; “LLSOAs describes a geographical breakdown of the UK, with an average population of 1500 people or 650 households, and are widely used to improve the reporting of small populations in NHS data modelling.” The Point Topic database and the identification of appropriate measure of broadband provision -&gt; “We emphasise the BII to be a measure of provision, not access or uptake and, just as standard practice with the use of IMD, it defines the characteristic of a geographical unit, the LLSOA, not the individuals who may live in it.” This is an accepted method in the reporting of small populations in NHS data modelling. We are using the</td>
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information about an individual’s LLSOA. Our method allows us to identify for an individual what their LLSOA is and what association that had on their health outcome. This is in contrast to the way in which we have interpreted the reviewers point which is “have we used the health outcomes associated with a single house to infer something about an individual or group of individuals who may be in the same house?”

Respectfully we do not feel this is a major limitation on the basis of the points made above and hope we have reassured the reviewer.

We would also like to thank the reviewer for making the point regarding the distinction between access and provision which we have now ensured is consistent throughout the manuscript.

Individual access, the distinction from provision, and the challenges associated with this are discussed in the introduction and discussion sections.

Individual access is dependent on sufficient provision which requires sufficient responses from authorities and is arguably more effective method for addressing the digital determinants of health as per the discussion in our paper.

We acknowledge that the the reviewer makes a point regarding digital access rather than provision. We have made it explicit in the paper that our point relates to provision rather than access. E.g.

Discussion -> The distinction between provision and uptake also requires emphasis, perhaps crudely summarised as the distinction between public provision and individual access…

Population and localities -> “We again emphasize that IMD and BII data are derived from rankings relating to the locality codes and not from direct assessment of individuals and we do not have individual socio-economic data.”

Caveats, Strengths and Weaknesses-> “We recognise that the BII is a geographical parameter and does not tell us about individual digital exclusion, since we do not have such assessments, just as the use of IMD is taken in lieu of individual detailed socio-economic data.”

For example when you say all patients do you mean minors too? The reviewer raises an important point. On the basis of the reviewers comments we have identified in the paper that

“All patients, including children and young people, registered…”

Whilst not stated in the paper we would like to articulate
here for the reviewer our reasoning. This is also linked to the point made previously.

The decision to include children is on the basis that they too will have a health outcome that is affected by their provision and other factors identified in the manuscript.

This is a novel area that can potential have a high impact.

The authors would like to thank the reviewer for their comments and we were pleased to read that you found our work to be novel with a potential for high impact. We would once again like to thank the reviewer for their time and effort in helping us improve our manuscript.

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<th>Authors response</th>
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<td>I can confirm the statistical method added to examine the association of various independent variables with poor or least BII.</td>
<td>The authors would like to thank the reviewer for their comments and confirming our statistical method.</td>
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| In the statistical method section, please add the sentence on how to categorize the IMD and age groups. | The authors would like to thank the reviewer for their insight into binary logistic regression. Please can we reassure you that the IMD and age were not used as continuous variables but rather quintiles and on the basis of your comments stated this in the paper which now reads 

**Statistical method-> For the independent variables of IMD and age, these were categorised according to quintiles and thus utilised as categorical variables. Comorbidities was categorised as those with a total sum comorbidity score less than three and a total sum score of greater than or equal to three.** |
| Though the authors added "......and 2) variables of deprivation; the two health outcome variables of long-term condition multimorbidity.....", the model of step 2 in table 2 included "comorbidities present", not "multimorbidity". Please confirm and revise this confusion. | The authors would like to thank the reviewer for identifying this and have now amended the terminology to refer to comorbidity throughout. We acknowledge there are several viewpoints on the definition and semantics regarding comorbidities and multi-morbidities. With which we do not wish to confuse the reader. We have provided a definition of how co-morbidities was used in this paper and provided further information on how it was included in the logistic regression. This is identified in the sub-heading of The Wolverhampton Integrated Healthcare database. |

**VERSION 2 – REVIEW**

| REVIEWER | Mitsutake, Seigo  
Tokyo Metropolitan Institute of Gerontology |
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<th>REVIEW RETURNED</th>
<th>22-Aug-2022</th>
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<tr>
<td>GENERAL COMMENTS</td>
<td>This Reviewer confirmed the responsive revision.</td>
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