**Author’s response to reviews**

**Title:** Morbidity, mortality and missed appointments in healthcare: a national retrospective data linkage study.

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Reviewer #2: This is an interesting study that this reviewer enjoyed reading. As the authors acknowledge that missed appointments and mortality is unlikely to be causal - is there anything that the authors can do can look at this in more detail? They mentioned dementia - can they look at this and other comorbidities in their modelling? Also can any markers of potential disease severity be controlled for?

Dementia was included in the list of mental health conditions. This, along with other comorbidities are included in the models in figures 1 and 4. We have further clarified this by including names of all multimorbidities in variables given in Appendix C.

Markers of disease severity e.g. examination findings and laboratory test results were unfortunately not available for this study.

Presumably some patients will miss appointments because they are hospitalised? Do the authors have access to secondary care data? If not can (repeat) missed appointments be looked at that in terms of those that are close together (e.g. within 30 days) vs those that are missed with a longer time apart (e.g. 3 months) to try and disentangle potential acute vs chronic reasons for missing appointments?

The authors have access to limited hospitalisation data but, unfortunately due to data restrictions we are not able to ascertain the ICD-10 code that would inform us of the reason for hospitalisation. We think it unlikely in any event that missing appointments because of hospital admission would be a repeated pattern for many patients. We have addressed the second point and included it as a supplementary figure within the paper (Appendix B and described on lines
173-177). We believe this shows, along with our earlier paper, that those with chronic conditions (i.e. those who are likely to have more than 1 appointment 30 days before or after their current appointment) do not have a specific pattern of missing appointments.

Reviewer #3:
This well-written paper describes a well-designed and executed innovative study with important new results. It certainly merits publication, subject to a few minor amendments.

Summary
It would be helpful to include that the analysis covered the appointment history for the three years before the follow-up period.

We have now highlighted this on lines 35-36.

Line 106 "Routine data were extracted".
It would be helpful if the authors could list, perhaps in the supplementary material, the categories of data included in the extract.

This has been included in Appendix C and referenced in lines 122-123.

Did the participating practices provide data on all their patients or were there any restrictions? I was amazed that in many categories there were no missing data!

Practices provided all data on their patients to Albasoft, the NHS trusted third party who extracted their data. However, there are some limitations on the data that Albasoft were able to provide to the research team due to issues of ethics and confidentiality. This included the postcodes of the areas where patients lived, and their exact dates of birth: we were provided with only their age.

Despite this, there is some missing data for a small proportion of the patients, particularly in their age (0.2% missing) and SIMD score (2.3% missing), which is indicated in table 1.
There was no missing data for long term conditions due to this being a variable that was produced from the patients appointment coding (read codes) and prescriptions, which was available for all patients in this study.

It would be helpful to indicate what proportion of the Scottish population the cohort represents. Information on the proportion of the Scottish population is provided in lines 37-38.

L 155 Can the authors confirm that the 824,374 patients in the cohort were all alive on 5 September 2016? Could any denominator bias have been introduced by patients leaving NHS Scotland during the follow-up period or numerator bias from having died outside Scotland? If so, mention in "Limitations".

We have mentioned this limitation on lines 275-276.

L219 I think "missed appointments" should be replaced by "all-cause mortality".

This error is has been corrected (line 226).

L260 "A pattern of repeatedly missing appointments is thus a potentially valuable clinical marker both for multiple morbidity and for increased risk of premature mortality" I agree that the study shows repeated missed appointments are a valuable marker for increased risk of premature mortality i.e. something that has not yet happened. I'm not sure it is worth saying they are also a valuable marker for multiple morbidity as that will already be obvious from the clinical record.

This has been corrected by removing mention of multiple morbidity on line 279.

L273 "larger appointment booking intervals". This is unclear. Do you mean "longer delay between the appointment being booked and taking place"? 

This has now been corrected on line 291-292.

L277 Limitations. I think it is preferable to place this paragraph near the beginning of the discussion, after the summary of the main findings. Having in mind the possible weaknesses of
the study can help the reader evaluate how the authors interpret and contextualise their findings in the rest of the discussion.

As suggested, the limitations section now starts on line 268 after the summary of results.

Appendix A Last category in the table. Should be "psychoactive" rather than "photoactive"!

This has been corrected. Please note: with addition of some new appendices following our revisions, the original Appendix A is now Appendix C