

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Factors influencing effectiveness of remote patient monitoring interventions: A realist review
AUTHORS	Thomas, Emma; Taylor, Monica; Banbury, Annie; Snoswell, Centaine; Haydon, Helen; Gallegos Rejas, Victor; Smith, Anthony; Caffery, Liam

VERSION 1 – REVIEW

REVIEWER	Baig, Mirza M Auckland University of Technology
REVIEW RETURNED	03-May-2021

GENERAL COMMENTS	<p>Manuscript: bmjopen-2021-051844 Title: Factors influencing effectiveness of remote patient monitoring interventions: A realist review</p> <p>This study aimed to explain the variation in remote patient monitoring (RPM) related outcomes. The authors reported 31 factors distributed into six theories.</p> <p>RPM is a very active research area at the moment due to the COVID-19, with huge global interest. Overall, the aim and approach of this study is a good fit and suitable for the BMJ readers, however there are some concerns need to be addressed.</p> <ul style="list-style-type: none">• Introduction seems to be a bit vague and missing key intro points on the specifics of RPM around this review. Last paragraph needs to be elaborated to introduce the topic and aims/ research questions to the readers. The two aims in the last para of the intro needs to be aligned with the aims mentioned in the abstract.• Methodology and approach mentioned is not a clear representation of the vast area of RPM and does not justify the inclusion and exclusion criteria used, needs elaboration on the use of 'realist review' and why it is different to other methodologies.• Section, 'Accurately detect a decline in health' is (I think) not the purpose of the RPM and this review? For RPM to 'detect' it needs to have patient's historic data and other several data points to detect the decline in health. Moreover, RPM in general used for remotely monitoring patients and less of decision support remotely.• The mentioned and discussion of key dependencies for RPM to function are missing, such as, connected devices, internet, patients understanding of the system, loading the data and more• Overall, results missed the point on how RPM supports the two aims mentioned in this study, for e.g., enhance self-management might be connected to RPM somewhat but not considered a major factor when looking at a self-management of a long-term condition.
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	<ul style="list-style-type: none"> • Recommendations for RPM is very generic and not adding any new info for readers • Discussion is good for the selected studies and factors. • I wonder what the fundamental differences between this study and the previous study published by the same authors in BMJ are - https://bmjopen.bmj.com/content/11/3/e040232 • Section 4 Conclusion is short, does not highlights the current limitations, directions to overcome the reported limitations are partially covered but future directions are missing • References need to be rechecked for completeness • Some sections are confusing and needs, rewording/revising of the whole paper would be good for the readers
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REVIEWER	Streetly, Allison King's College London, Population Health Sciences
REVIEW RETURNED	03-May-2021

GENERAL COMMENTS	<p>The paper is important and of interest but I think the presentation needs to be tightened up in several places.</p> <p>In particular the outcome of interest in this paper is prevention of acute admissions but this is not always clear and discussion is often wider than this.</p> <p>Abstract - section on outcome measures needs to be clearer. Explain the realist view in the design section.</p> <p>Results: make clear its about “effective” targeting</p> <p>Introduction section ; would be helpful if you presented some consideration of model of care/pathway of care concept as this suddenly pop out in the conclusions. I think the theme of it being more than a technology is important but literature could be clearer reasons for this – its not unique to this model of care.</p> <p>Intro - Para three explain that the focus is on admissions rather than patient outcomes as there are many other than hospital admission and not clear</p> <p>Methods: explanation of the theory of the methods used would fit better in the introduction to justify why used and methods focus on the “doing”/tightly focused on what you did.</p> <p>Results: there is a lot of presentation of factors which may make this model of care work but much less about negative factors. It would be more balanced if there is was stronger consideration of the adverse factors along with the positive factors as these are just as important.</p> <p>Discussion :</p> <p>Whilst you assume that focus on those who are sickest is most effective (this may be correct in absolute terms) it may be that in relative risk reduction terms monitoring those with less severe conditions is over the longer term more effective. You might want to consider this more carefully in terms of the outcome of interest- short term reduction in admissions over a short period of time or longer term reduction in health – or at least focus the discussion so you are clear on the outcomes of interest and the limitations of focusing on that (saves money but maybe doesn’t make as much difference to the longer term outcomes).</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer 1			
No.	Reviewer comment	Author response	Line
1	RPM is a very active research area at the moment due to the COVID-19, with huge global interest. Overall, the aim and approach of this study is a good fit and suitable for the BMJ readers, however there are some concerns need to be addressed.	Thank you	N/A
2	Introduction seems to be a bit vague and missing key intro points on the specifics of RPM around this review. Last paragraph needs to be elaborated to introduce the topic and aims/ research questions to the readers. The two aims in the last para of the intro needs to be aligned with the aims mentioned in the abstract.	<p>Thank you. The design section in the abstract has been elaborated to include more description around the realist review methodology.</p> <p>“Design: Realist review - a qualitative systematic review method which aims to identify and explain why intervention results vary in different situations.”</p> <p>The wording of the study aims in the abstract now aligns with the introduction:</p> <p>“Therefore, this study aimed to explore these results further to (1) identify factors of RPM interventions that relate to increased and decreased acute care use, and (2) develop recommendations for future RPM intervention design and implementation.”</p>	<p>46</p> <p>43-44</p>
3	Methodology and approach mentioned is not a clear representation of the vast area of RPM and does not justify the inclusion and exclusion criteria used, needs elaboration on the use of ‘realist review’ and why it is different to other methodologies.	<p>With respect to ‘elaboration on the use of realist review’. We have included additional information on the realist review methodology in the manuscript</p> <p>.....using realist review methodology to identify factors that determine intervention success and failure in various contexts. This review was guided by the work of Pawson et al (2005)¹⁹ and followed guidelines outlined by the Realist and Meta-narrative Evidence Synthesis: Evolving Standards (RAMESES; Appendix A)²⁰. According to the methodology described by Pawson et. al.¹⁹ information was extracted that related to context (settings, populations, intervention delivery);</p>	<p>146-154</p>

		<p>outcomes (positive, negative or null effect on outcome of hospital use), and potential mechanisms or reasons behind the results (e.g. author's interpretation as to why the interventions did or did not work). These data were recorded in an Excel spreadsheet to facilitate a structured analysis.</p> <p>With respect to inclusion and exclusion criteria. This study is a secondary analysis of our original review published in BMJ Open which provides in-depth details of the search strategy. We provide a brief overview of the systematic search process in this paper in the methods section and alert readers to the full paper: "Complete details of the original systematic review have been described elsewhere.¹³ "</p> <p>Paragraph 4 & 5 of the introduction provides an overview of the findings from the initial systematic review and reasons why a realist approach was employed to further investigate the variation in outcomes. (This has been moved from the method section as per comments by Reviewer 2)</p>	<p>136-7</p> <p>108-126</p>
4	<p>Section, 'Accurately detect a decline in health' is (I think) not the purpose of the RPM and this review? For RPM to 'detect' it needs to have patient's historic data and other several data points to detect the decline in health. Moreover, RPM in general used for remotely monitoring patients and less of decision support remotely.</p>	<p>This statement from the reviewer is incorrect. A fundamental goal of RPM is to identify a decline in health. RPM continually monitors biometrics (e.g. daily). Hence there are 'data points' available to detect decline. RPM is not just to collect data but to use that data to make clinical decisions (therefore supporting decision support).</p>	N/A
5	<p>The mentioned and discussion of key dependencies for RPM to function are missing, such as, connected devices, internet, patients understanding of the system, loading the data and more</p>	<p>These factors that the reviewer mentions are not always relevant (e.g. cardiac implantable devices do not require access to the internet or patient understanding of the system). We mention this additional advantage of implantable devices. We can only report on what was documented in the papers and these factors were not dominant themes.</p>	N/A

		<p>However, we do discuss the importance of providing devices that are simple and easy to use in multiple aspects of the paper.</p> <p>Additionally, in the discussion, we discuss the importance of focusing on other factors related to the model of care, not just the technology aspects.</p> <p>“To date, much of the focus of RPM innovations has been on the design and development of the technology.^{62, 63} While functioning technology that accurately detects a decline in health is important, to deliver significant benefits RPM alerts must also lead to an actionable and timely responses. To achieve positive results at the healthcare system level, RPM interventions require a change to the model of care rather than simple technology implementation.⁶⁴”</p>	363-367
6	Overall, results missed the point on how RPM supports the two aims mentioned in this study, for e.g., enhance self-management might be connected to RPM somewhat but not considered a major factor when looking at a self-management of a long-term condition.	<p>The two study aims are to identify factors of RPM interventions that relate to increased/decreased acute care use and to provide recommendations for future RPM use. We believe the paper aligns well with these two aims.</p> <p>Enhancing self-management through the provision of feedback was a strong theme throughout the included studies that reduced acute care use and thus already included in our findings.</p>	n/a
7	Recommendations for RPM is very generic and not adding any new info for readers	<p>To the best of our knowledge this is the only realist-review on RPM.</p> <p>Some recommendation may appear generic or obvious it is still important to include all recommendations that were found (as opposed to selective reporting).</p> <p>The presented recommendations arise from this robust methodology. Hence, this review adds rigour to recommendations that may have been previously lesser quality of evidence (e.g. anecdotal).</p>	n/a

		Other, reported recommendations are novel (e.g. the importance of nurse-led services). Hence, we are very confident we have included new info for readers.	
8	Discussion is good for the selected studies and factors.	Thank you	n/a
9	I wonder what the fundamental differences between this study and the previous study published by the same authors in BMJ are - https://bmjopen.bmj.com/content/11/3/e040232	<p>The fundamental differences are the methodology (systematic review verse realist review), the methods (quantitative verse qualitative), and the research question that was answered by each study (Can RPM reduce acute care use? verse Why is there variability in effectiveness of RPM?)</p> <p>We have further clarified by adding the following to the manuscript.</p> <p>“Our recent systematic review determined that remote patient monitoring (RPM) interventions can reduce acute care use. However, effectiveness varied within and between populations. Researchers, policymakers and implementers require more than evidence of effect; they need guidance on how best to design RPM interventions. Therefore, this study aimed to explore these results further to ...”</p>	n/a 39-44
10	Section 4 Conclusion is short, does not highlights the current limitations, directions to overcome the reported limitations are partially covered but future directions are missing	<p>We have purposefully kept the conclusion concise. Limitations and future directions are provided in the last two paragraphs of the discussion. The future directions have now been moved to the conclusion</p> <p>“Future studies should investigate any unintended consequences of RPM and cost implications resulting from the shifting of care.”</p>	434-436
11	References need to be rechecked for completeness	The references have been re-checked and some minor edits made. The updated details of our	n/a

		original BMJ Open review are now available online and have now been included.	
12	Some sections are confusing and needs, rewording/revising of the whole paper would be good for the readers	We have now re-revised the entire manuscript. We feel the writing is clear and concise and very readable. However, if more specific feedback is provided we are happy to address.	n/a

Reviewer 2			
No.	Reviewer comment	Author response	Line
13	The paper is important and of interest but I think the presentation needs to be tightened up in several places.	Thank you	N/A
14	In particular the outcome of interest in this paper is prevention of acute admissions but this is not always clear and discussion is often wider than this.	Thank you. We've reviewed the paper to ensure the focus remains on the outcome of interest. In aspects where we talk more broadly about RPM in the discussion, we have specifically stated this (as described in sections below). Additionally, we've deleted the section in the discussion that talks about self-management in a context that is potentially broader than is relevant for this review.	n/a
15	Abstract - section on outcome measures needs to be clearer. Explain the realist view in the design section.	Realist review now briefly explained in the design section "Design: Realist review - a qualitative systematic review method which aims to identify and explain why intervention results vary in different situations."	46
16	Results: make clear its about "effective" targeting	The abstract has been significantly re-worked. The objectives, design outcomes and result section should now enhance the clarity that this is a secondary analysis of a review that focused on quantitative outcomes of effect. This follow-up paper provides a qualitative analysis to determine contextual factors and mechanisms that led to the variation in outcomes.	39-65
17	Introduction section ; would be helpful if you presented some consideration of model of care/pathway of care concept as this suddenly pop out in the conclusions. I think the theme of it being more than a technology is important but literature could be clearer reasons for this – its not unique to this model of care.	We now introduce models of care within the introduction. "One of the main drivers of healthcare costs for chronically ill patients results from acute hospital admissions due to their intense resource requirements. Consequently, new models of care are being widely investigated and	84-5

		<p>trialled that could extend care into the home and prevent unnecessary acute care events.”</p> <p>We have also further clarified in the conclusion that we are referring to “...RPM devices, systems and telehealth models of care.”</p>	428
18	Intro - Para three explain that the focus is on admissions rather than patient outcomes as there are many other than hospital admission and not clear	<p>We explain that our previous review focused on acute care use including hospital admissions events, hospital length of stay and emergency department presentations.</p> <p>We’ve now also clarified throughout the paragraph that we are referring to acute care use.</p>	intro
19	Methods: explanation of the theory of the methods used would fit better in the introduction to justify why used and methods focus on the “doing”/tightly focused on what you did.	The explanation of the realist review methodology has now been moved to the introduction section.	120-128
20	Results: there is a lot of presentation of factors which may make this model of care work but much less about negative factors. It would be more balanced if there is was stronger consideration of the adverse factors along with the positive factors as these are just as important.	<p>The factors associated with increased hospital admission are highlighted in Figure 2 & discussed under the paragraph ‘Factors that resulted in increased acute care use’. As many of these factors are the opposite of successful interventions (e.g. slow alert response time is the opposite of providing timely care) we felt it would be repetitive to go through this in the same detail as the successful factors. We have now highlighted this specifically in the results. Further, we’ve woven the negative factors into the discussion more.</p> <p>Finally, the number of negative factors (10) are much smaller than the positive (21). This is potentially a reporting bias that we have now included in the limitation sections.</p> <p>“Potentially the higher number of studies reporting positive outcomes may be due to a reporting bias within the literature; consequently, there were a higher number of factors discussed in relation to reducing (n=21) rather than increasing acute care use (n=10).”</p>	320-328 410-412

21	<p>Discussion :</p> <p>Whilst you assume that focus on those who are sickest is most effective (this may be correct in absolute terms) it may be that in relative risk reduction terms monitoring those with less severe conditions is over the longer term more effective. You might want to consider this more carefully in terms of the outcome of interest- short term reduction in admissions over a short period of time or longer term reduction in health – or at least focus the discussion so you are clear on the outcomes of interest and the limitations of focusing on that (saves money but maybe doesn't make as much difference to the longer term outcomes).</p>	<p>The outcomes of interest are acute hospital use and the data suggests that this is most effective in the more acutely unwell population group which is why we have reported on this.</p> <p>To make this clearer we've now split this section into two paragraphs 1) discussing the patient-related factors we determined that impact acute care use and 2) what the broader literature reports on patient-related factors to support longer-term monitoring of conditions.</p>	Discu- ssion
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VERSION 2 – REVIEW

REVIEWER	Streetly, Allison King's College London, Population Health Sciences
REVIEW RETURNED	28-Jul-2021
GENERAL COMMENTS	<p>Has responded and clarified many publications. Note that publications included up to 2020 only</p> <p>Some help with grammar and spelling will be needed at the proof stage.</p>