PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Impact of a pharmacist-prepared interim residential care medication administration chart on continuity of medication management after discharge from hospital to residential care: a prospective pre- and post-intervention study (MedGap Study)
AUTHORS	Rohan A Elliott, Tim Tran, Simone E Taylor, Penelope A Harvey, Mary K Belfrage, Rhonda J Jennings and Jennifer L Marriott

VERSION 1 - REVIEW

REVIEWER	Kenneth Boockvar, MD, Associate Director, Geriatrics Research, Education and Clinical Center, James J. Peters VA Medical Center, Bronx, NY, USA
REVIEW RETURNED	23/02/2012

GENERAL COMMENTS	General comments: This manuscript describes an evaluation of a new process for ensuring continuous and correct medication administration when a patient is transferred between a hospital and a residential care facility (RCF), with the goal of preventing missed or significantly delayed doses. The main intervention was the creation of a 7-day interim medication administration chart (IRCMAC) by the hospital dispensing software, with additional details added by the hospital pharmacist. This chart, plus a supply of new and changed medications, were sent with the patient to the RCF to be administered to the patient until medication orders could be written. The authors show that the percentage of patients with 1 or more missed or significantly delayed doses decreased from 18% before the intervention to 3% during the intervention. The strengths of the paper are the novelty of the intervention, the clarity of writing, and the strongly positive results. A weakness of the paper is that the main outcome (missed or significantly delayed dosage) is by self-report by the RCF staff member over the phone, not blinded to intervention or control, and not independently verified. In addition, this intervention could only work in places that have regulations that would permit this. Specific comments: 1) Methods: Why were patients with no medication changes in the hospital excluded? Did they receive the intervention or not? It seems that the intervention could still be effective even in those who had no medication changes. If they received the intervention they should be included. 2) Methods: How many days' supply of prescribed medication did the hospital send to the RCF? Would the intervention work in places where the hospital is not permitted to or does not supply medication to RCFs? 3) Methods, data collection: Please state the exact reliability and

	validity testing results for the outcome ascertainment method by telephone self-report (from reference 2). 4) Results: Please describe the RCFs (average number of beds, private or for-profit ownership, staffing) and the distribution of subjects across the RCFs. Were subjects evenly distributed among the RCFs or were there some RCFs that received a majority of the subjects? Were there any differences between the pre-intervention and post-intervention RCFs in characteristics or subject distribution? Were there any RCFs in which the intervention did not work, and, if so, why? 5) Results: What was the difference in average time from hospital discharge to GP visit in the RCF in pre- and post-intervention periods? 6) Discussion: It seems that a necessary component of the intervention was that the hospital supplied prescribed medications to be given during the time between hospital discharge and the GP visit in the RCF. If this is true, it should be stated clearly. In addition, if this is true, it should be acknowledged that the intervention might not be able to be implemented in places in which the hospital does not do this. 7) Discussion: If there was in increase in average time from hospital discharge to GP visit in the RCF as a result of the intervention, please discuss the possible unintended adverse effects of this delay in GP visit, like delayed recognition of a serious condition that then requires hospital readmission. 8) Table 3: Consider deleting this table and putting the survey results in the narrative results section and putting the quoted comments in Table 2 and renaming Table 2 to include comments from GPs.

REVIEWER	Professor Leonard C Gray, Director, Centre for Research in Geriatric Medicine, the University of Queensland, Brisbane, Australia.
REVIEW RETURNED	04/03/2012

GENERAL COMMENTS	This study appears to demonstrate that in the Australian hospital and long term care system, a mechanism to permit immediate prescription of medications at arrival from hospital to the residential aged care facility reduces the pressure on General Practitioners (GP) to attend the residential care facility (RCF) to write the medication chart. It also reduces the need to involve locum doctors when the GP is not immediately available to attend. The rationale for the intervention is well stated, indicating that a time gap in medication administration might result in patient discomfort, deterioration in health status or medication errors, and some evidence to support this proposition is offered from the literature. It is not clear whether this problem is uniquely Australian. The value of this study to an international (or British) audience will depend on whether this problem exists in other jurisdictions. The authors have not indicated whether this is the case. The study design is before – after. The limitations of this design are acknowledged by the authors. Although a variety of parameters appear well matched, it is still possible that organisational behaviours (nursing staff, GPs, etc) may have been adjusted in the intervention period in such a way to bias the results. The findings may have been more convincing had a randomised controlled trial been conducted. The authors should indicate whether this was considered, and why the presented design was preferred. Notwithstanding these concerns, the evidence presented suggests

	that the effect of the IRCMAC intervention was real – time delays in commencement of medication were reduced. There is no evidence that this resulted in improved outcomes for the patient (the study was not designed to detect outcomes) but it does appear to be welcomed by GPs who presumably were able, at times, to defer visits to the RCF to a more convenient time. The attendance of medical practitioners at the RCF is (hopefully) not only to write a medication chart. Presumably, the GP will visit the patient, assess their status, make a physical examination, and make recommendations regarding assessment and treatment. These tasks (at least in part) underpin the rationale for the need for the medication chart to be written by a medical practitioner. The results indicate that in the post-intervention period, 77% of patients did not have their RCF long term medication chart written in time for their first scheduled medication dose. The paper does not present the equivalent result for the pre-intervention period. In the previously published paper the proportion reported was 62%. This suggests that doctors delayed their visits because of the IRCMAC process. Is there not a risk that this intervention might have the inadvertent effect of delaying attendance of the GP? This delay might even increase over time. The IRCMAC is for 7 days (why not 1 or 2 days?), raising the possibility that over time the GP might attend at day 7. A comment on this issue by the authors might be useful. The cost of the IRCMAC appears modest (it would not be difficult for the authors to delineate the cost in the paper). While the authors state that the intervention is being offered in other jurisdictions, it is not clear whether it is being continued in the study setting. Continuation is evidence of efficacy. Clarification of this point would be helpful to the reader considering using this strategy. This study reports an administrative intervention that appears effective in improving system efficiency, and which has the potential to improve patient outcomes at a modest cost. There is a possibility that in an environment where GPs are busy and in short supply, it might have an inadvertent effect on deferring GP attendance. Ultimately, the value of this intervention will be measured in terms of reductions in medication related adverse affects on the patient or by reducing the cost of health care delivery (without affecting patient outcomes).

VERSION 1 – AUTHOR RESPONSE

Reviewer: Kenneth Boockvar, MD, Associate Director, Geriatrics Research, Education and Clinical Center, James J. Peters VA Medical Center, Bronx, NY, USA

General comments:
This manuscript describes an evaluation of a new process for ensuring continuous and correct medication administration when a patient is transferred between a hospital and a residential care facility (RCF), with the goal of preventing missed or significantly delayed doses. The main intervention was the creation of a 7-day interim medication administration chart (IRCMAC) by the hospital dispensing software, with additional details added by the hospital pharmacist. This chart, plus a supply of new and changed medications, were sent with the patient to the RCF to be administered to the patient until medication orders could be written. The authors show that the percentage of patients with 1 or more missed or significantly delayed doses decreased from 18% before the intervention to 3% during the intervention. The strengths of the paper are the novelty of the intervention, the clarity of writing, and the strongly positive results. A weakness of the paper is that the main outcome (missed or significantly delayed dosage) is by self-report by the RCF staff member over the phone, not blinded to intervention or control, and not independently verified. In addition, this intervention could only work

in places that have regulations that would permit this.

Specific comments:
1) Methods: Why were patients with no medication changes in the hospital excluded? Did they receive the intervention or not? It seems that the intervention could still be effective even in those who had no medication changes. If they received the intervention they should be included.

* Patients who had no change to their medications and were returning to a RCF were excluded because they did not need a new RCF medication chart (the RCF would have a chart that is still current and accurate). Patients with no changes but discharged to RCF for the first time were not excluded as they would still need a new RCF medication chart. We have clarified this in the manuscript (Methods p9 and Figure 1)

2) Methods: How many days' supply of prescribed medication did the hospital send to the RCF? Would the intervention work in places where the hospital is not permitted to or does not supply medication to RCFs?

* A minimum of 1 week's supply was provided. We have clarified this in the Methods section of the revised manuscript. The interim medication administration chart (IRCMAC) could still reduce pressure on the GP workforce, the need for locum doctor attendance, and the risk of medication errors if the hospital provided no medications. The IRCMAC provides RCF staff with clarity as to what the intended discharge regimen is, hence if pre-admission medications are available at the RCF, they can be given correctly and without delay. For new or changed medications, whether the IRCMAC would be effective will depend on how the medications are supplied - if delays in medication supply and/or delivery occur then missed doses may still occur until the medications become available, but if the medications are supplied on time then the IRCMAC will facilitate timely and accurate administration. We have added some comments about this in the Discussion section (p17).

3) Methods, data collection: Please state the exact reliability and validity testing results for the outcome ascertainment method by telephone self-report (from reference 2).

* It was not possible to determine the exact reliability and validity of the data collection method. In reference 2 we described how we attempted to validate the telephone interview data using two methods, but both methods turned out to be highly unreliable and prone to over-estimation of the rate of missed/delayed doses. The first involved asking RCF staff to fax a copy of the RCF medication chart to us once it was written; response rate was poor, and due to the large number of workarounds used by RCF staff to administer and/or record medications when the chart wasn't written in time for the first dose, the faxed chart could not always confirm whether doses were given (eg. the chart indicated no dose was given, but the phone interview indicated it was given, for example without signing a drug chart, or by getting a family member to administer it). The second method involved a researcher visiting RCFs after discharge to retrospectively collect data, but again this was unable to confirm whether doses were administered, due to variable documentation and workarounds.

Alternative data collection methods were also considered or piloted, but were either not feasible or were found to be less reliable than telephone interview. Sending a researcher to each RCF to observe medication administration was not feasible because of the number of discharges each day, usually at short notice, and the number of different RCFs. This method would also be likely to have a Hawthorn effect. We piloted a fax-back form, sent to RCFs with each patient, to be completed prospectively by RCF staff. However response rate was poor and again there was risk of a Hawthorn effect.

All of this information is available in Reference 2, and this is referred to in the Methods section, so we have not repeated it in the current manuscript.

4) Results: Please describe the RCFs (average number of beds, private or for-profit ownership, staffing) and the distribution of subjects across the RCFs. Were subjects evenly distributed among the RCFs or were there some RCFs that received a majority of the subjects? Were there any differences between the pre-intervention and post-intervention RCFs in characteristics or subject distribution? Were there any RCFs in which the intervention did not work, and, if so, why?

* We do not have data describing the characteristics of RCFs, other than the type of care provided (see Table 1 of the manuscript). There was no difference in type of care provided at RCFs between the pre- and post-intervention periods. The reason we have no other details about the RCFs is because the RCFs were not recruited prior to the study; they were only called when a patient was discharged to them from a participating hospital. The structured interview was administered to care staff and hence it focussed on medication management issues and we did not ask for details about ownership, number of beds or staffing levels.

Patients were not evenly distributed across the RCFs, but the distribution was similar in the pre- and post-intervention periods. In both periods RCFs received a median of 2 patient transfers, with an inter-quartile range of 1 to 3. The maximum number of transfers to any single RCF in the pre-intervention period was 9 (out of 202), and in the post-intervention period it was 14 (out of 226). In the pre-intervention period the top 10 RCFs received 32% of transfers; in the post-intervention period the top 10 RCFs received 33% of transfers. Seven of the top 10 RCFs were the same in the two periods. We have added some information about the distribution of patients across the RCFs in the Results section (p12) and Figure 1.

The similar distribution of subjects and similar type of care in the two study groups suggests the RCFs in the two groups were similar.

The intervention seemed to be broadly effective. Missed and delayed doses were not concentrated in any particular RCF(s). In the post-intervention period the 6 identified missed/delayed doses occurred at 6 different RCFs, each of which had received between 3 and 5 transfers during the post-intervention study period. The IRCMAC was not used by RCFs in only 11% of patient transfers (reported in the Results section); we have added some comments about the reasons the IRCMAC was not used in these cases in the Discussion section (p16).

5) Results: What was the difference in average time from hospital discharge to GP visit in the RCF in pre- and post-intervention periods?

* We did not record how many days it took for GPs to attend the RCFs after discharge; as described in the ‘Data collection’ section of the Methods, we only asked (at Day 1 and Day 8) whether the RCF long-term care medication chart had been written, and by whom it was written.

7) Discussion: If there was in increase in average time from hospital discharge to GP visit in the RCF as a result of the intervention, please discuss the possible unintended adverse effects of this delay in GP visit, like delayed recognition of a serious condition that then requires hospital readmission.

* Although we do not know whether there was a change in the time from hospital discharge to first GP visit, the IRCMAC was limited to 7 days duration in order to ensure that a GP visit and clinical review

would occur within 1 week of discharge. We would argue that 'safe discharge' should not require clinical review by a GP on the day of arrival at the RCF. The urgency for GP or locum attendance on the day of discharge is driven by the need for a current drug chart rather than the need for urgent clinical review, and, in practice, there may not be meaningful clinical review when a doctor is called to the RCF on the day of discharge, particularly if that doctor is a locum doctor who does not know the patient. By providing the IRCMAC, clinical review can be planned and can occur at an appropriate time during the week after discharge.

Although we didn't record for how long the IRCMACs were used at the RCFs before the GP attended to write a long-term care medication chart, anecdotally (from the telephone interviews) we know that the IRCMACs were usually used for less than 7 days, and sometimes for less than 24 hrs – that is, the IRCMACs were used (as intended) as an interim measure only until the GP could attend to review the patient and write a new long-term care chart.

Whilst there is a potential risk that the IRMCAC may delay GP review of an unstable patient, the risk is likely to be smaller with the IRCMAC than without the IRCMAC. This is because, without the IRCMAC, a locum is often called to write a long-term care medication chart on the day of discharge, and this chart will last for up to 6 months; therefore the patient's GP can delay their attendance for much longer than 7 days.

It is also noteworthy that in our GP survey, no GP reported any adverse outcomes and GPs were highly supportive of the use of IRCMACs.

We have added some discussion about this to the Discussion section on page 14/15.

6) Discussion: It seems that a necessary component of the intervention was that the hospital supplied prescribed medications to be given during the time between hospital discharge and the GP visit in the RCF. If this is true, it should be stated clearly. In addition, if this is true, it should be acknowledged that the intervention might not be able to be implemented in places in which the hospital does not do this.

* As noted in point 2, above, the intervention could still work if the hospital didn't supply the prescribed medications. However, to completely avoid missed doses, the method of supply would need to ensure that medications were available at the RCF in time for the first dose (which, as per Table 1 of the manuscript, is usually 1 to 6 hours after discharge). If delays in medication supply and/or delivery occur then missed doses may still occur until the medications become available. We have added some comments about this in the Discussion section (p17).

8) Table 3: Consider deleting this table and putting the survey results in the narrative results section and putting the quoted comments in Table 2 and renaming Table 2 to include comments from GPs.

* Change has been made

Reviewer: Professor Leonard C Gray, Director, Centre for Research in Geriatric Medicine, the University of Queensland, Brisbane, Australia.

This study appears to demonstrate that in the Australian hospital and long term care system, a mechanism to permit immediate prescription of medications at arrival from hospital to the residential aged care facility reduces the pressure on General Practitioners (GP) to attend the residential care

facility (RCF) to write the medication chart. It also reduces the need to involve locum doctors when the GP is not immediately available to attend.
The rationale for the intervention is well stated, indicating that a time gap in medication administration might result in patient discomfort, deterioration in health status or medication errors, and some evidence to support this proposition is offered from the literature.

1) It is not clear whether this problem is uniquely Australian. The value of this study to an international (or British) audience will depend on whether this problem exists in other jurisdictions. The authors have not indicated whether this is the case.

* There is very little published literature on continuity of medication management following discharge from hospital to residential long-term care. In our Introduction we have mentioned the few studies that we located, and these studies do suggest that gaps in continuity of medication management exist outside of Australia, at least in North America. We believe that this study will be relevant to an international audience, because even if the specific processes of care (e.g. method of medication supply) vary between jurisdictions, the general principles and approach to ensuring continuity of care may be generalisable.

2) The study design is before – after. The limitations of this design are acknowledged by the authors. Although a variety of parameters appear well matched, it is still possible that organisational behaviours (nursing staff, GPs, etc) may have been adjusted in the intervention period in such a way to bias the results.

* Whilst it is possible that factors other than the IRCMAC could have contributed to the reduction in medication administration errors and locum attendances, we feel that this is unlikely to have been a significant confounder. The problems addressed by the intervention have been long-standing ones, and it is highly improbable that over the space of a few months they would decline significantly without specific intervention. The findings are also supported by feedback from RCF staff and GPs. We have added comments about this to the Discussion section (page 17).

3) The findings may have been more convincing had a randomised controlled trial been conducted. The authors should indicate whether this was considered, and why the presented design was preferred.

* An RCT was considered, but was not feasible for a number of reasons:
- An initial observation study (pre-intervention study) was required to quantify and explore the problem in order to inform the intervention. During the pre-intervention phase, it was determined that not having an up-to-date medication chart was the major barrier to continuity of medication management.
- Resources for the conduct of this study were limited, and using an RCT methodology after the baseline audit and development of the intervention would have introduced considerable complexity and cost. Time series analysis was considered, but was also not feasible within the resources of the project.
- It may have been confusing for hospital and RCF staff to create/use an IRCMAC for some patients, but not others. Creating the IRCMAC was integrated into the routine care provided by all ward pharmacists when patients were discharged.
- Cluster randomisation by facility was considered, but this would have required recruitment of RCFs in advance, which (with 90+ RCFs) was not possible within our resources. Also it was not possible to predict a priori exactly which RCFs would be accepting patients. Some of the recruited RCFs would not have had any patients transferred during the data collection period, and some non-recruited RCFs would have received patients. If certain facilities declined or were not included, this has the potential

for significant selection bias.

4) Notwithstanding these concerns, the evidence presented suggests that the effect of the IRCMAC intervention was real – time delays in commencement of medication were reduced. There is no evidence that this resulted in improved outcomes for the patient (the study was not designed to detect outcomes) but it does appear to be welcomed by GPs who presumably were able, at times, to defer visits to the RCF to a more convenient time. The attendance of medical practitioners at the RCF is (hopefully) not only to write a medication chart. Presumably, the GP will visit the patient, assess their status, make a physical examination, and make recommendations regarding assessment and treatment. These tasks (at least in part) underpin the rationale for the need for the medication chart to be written by a medical practitioner. The results indicate that in the post-intervention period, 77% of patients did not have their RCF long term medication chart written in time for their first scheduled medication dose. The paper does not present the equivalent result for the pre-intervention period. In the previously published paper the proportion reported was 62%. This suggests that doctors delayed their visits because of the IRCMAC process. Is there not a risk that this intervention might have the inadvertent effect of delaying attendance of the GP? This delay might even increase over time. The IRCMAC is for 7 days (why not 1 or 2 days?), raising the possibility that over time the GP might attend at day 7. A comment on this issue by the authors might be useful.

* See response to Reviewer 1 (point 5), above. Regarding the duration of the IRCMAC, to ensure that the chart would not 'run out' over a weekend (including extended public holiday weekends), it needs to last for at least 5 days. After consultation with GPs and RCFs, it was decided that the chart should be valid for 7 days rather than 5, in order to provide some flexibility for GPs in the scheduling of their visits to the RCF. For example, some GPs who have multiple patients at an RCF have a regular scheduled day on which they visit to attend to non-urgent patient care activities. By providing a 7 day chart, if the patient is stable and the GP's usual day of attendance is 7 days away, a 7 day chart avoids the need for the GP to make an extra visit, and/or the need for locum attendance. If the patient is unstable the GP (or locum if the GP in unavailable) can be called to attend sooner. We have added some discussion about this to the Discussion section on page 14/15.

5) The cost of the IRCMAC appears modest (it would not be difficult for the authors to delineate the cost in the paper).

* We had added the approximate cost to produce an IRCMAC in the Discussion section (p15).

6) While the authors state that the intervention is being offered in other jurisdictions, it is not clear whether it is being continued in the study setting. Continuation is evidence of efficacy. Clarification of this point would be helpful to the reader considering using this strategy.

* The intervention has been continued at the participating hospitals, and this is mentioned in the Discussion section on page 17.

7) This study reports an administrative intervention that appears effective in improving system efficiency, and which has the potential to improve patient outcomes at a modest cost. There is a possibility that in an environment where GPs are busy and in short supply, it might have an inadvertent effect on deferring GP attendance.

* The intervention is a practical response to GP workforce pressures (as well as unsafe medication

management practices). As noted above, the risk of deferred GP attendance may be lower with the IRCMAC than with use of locum doctors to write medication charts on the day of discharge.

8) Ultimately, the value of this intervention will be measured in terms of reductions in medication related adverse affects on the patient or by reducing the cost of health care delivery (without affecting patient outcomes).

VERSION 2 – REVIEW

REVIEWER	Kenneth Boockvar, MD Associate Director Geriatrics Research, Education, and Clinical Center James J. Peters VA Medical Center USA No competing interests to declare.
REVIEW RETURNED	05/04/2012

GENERAL COMMENTS	The authors have largely satisfied my comments and questions

REVIEWER	Len Gray, Professor in Geriatric Medicine, the University of Queensland, Australia. No competing interests.
REVIEW RETURNED	07/04/2012

GENERAL COMMENTS	The authors have responded appropriately to the majority of criticisms and made suitable adjustments to the manuscript. In some instances, they have indicated their inability to address issues, but in each case, the explanation is acceptable.