Remote monitoring of peritoneal dialysis: evaluating the impact of the Claria Sharesource system

Systems that allow remote patient monitoring of those performing home-based therapies are becoming increasingly important. A new system, called Claria Sharesouce, was introduced for people on automated peritoneal dialysis (APD) in the UK in 2016. The system automates the sending of dialysis data to renal units and allows clinicians to adjust dialysis cycler programmes remotely. Eleri Wood describes an evaluation of the Claria Sharesource system and discusses the implications for nursing behaviours, clinical practice and patient care

■ peritoneal dialysis ■ remote patient monitoring ■ home-based therapies ■ technology

Peritoneal dialysis (PD) is an important therapy option for people with kidney disease. It is particularly valued because it is home-based, flexible, and allows patients to be largely autonomous (Renal Association, 2017). Despite these advantages, the proportion of renal replacement therapy-dependent patients who are on PD remains low at 5.9% (UK Renal Registry, 2018). This is attributable to a variety of barriers. Paramount for many patients are anxieties about the safety of, or their ability to, perform their own therapy at home, without direct medical oversight (McLaughlin et al, 2003). Clinicians may underutilise PD because of concerns about their ability to determine patients' adherence (Wallace et al, 2017).

Successful maintenance of PD depends on patients monitoring and recording information daily, including weight and therapy outcomes. Clinicians are only able to review these records sporadically. As a result, clinicians have only partial, retrospective oversight of automated peritoneal dialysis (APD) and problems (such as inadequate ultrafiltration) may not become apparent until they are significant (Wallace et al, 2017). This may be days or weeks after initial signs appeared, by which stage they are more likely to require intensive or undesirable remedies, such as hospital admission or cessation of PD.

Remote patient monitoring (RPM) has the potential to overcome some of these issues, and in 2015 Baxter launched a new APD device, the Homechoice Claria, which integrates with a two-way remote patient management platform called Sharesource. This means that patients performing APD at home are connected via the internet to clinicians in their renal unit. The Homechoice Claria transfers therapy and patient biometric data to clinicians, allowing them to monitor the patient in real time. Clinicians may then intervene proactively, either by remotely changing the APD programme or contacting the patient, and thus resolve minor issues before they become major complications. Resources such as phone calls, home visits and clinic time may be targeted towards patients most in need, with subsequent reductions in the use of emergency attendances and admissions. Bi-directional systems such as Claria Sharesource therefore have the potential to bring widespread benefits by improving patient satisfaction, outcomes, and service efficiency (Wallace et al, 2017).

In particular, non-concordance with prescribed PD therapy will be immediately visible to clinicians. Non-concordance is prevalent and problematic: non-concordant patients are known to have significantly higher rates of death, hospital admission, and transfer to haemodialysis (Bernadini et al, 2000), and a recent systematic review by Griva et al (2014) revealed rates varying between 2.3% and 56% (depending on how it is defined). Early identification and intervention for

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patients struggling with concordance therefore has considerable potential to improve outcomes.

The principles of RPM for APD are widely accepted. Simulations have shown that early intervention enabled by bi-directional PD systems reduced admissions, home visits, emergency department attendances and urgent unplanned clinic visits and thus reduced costs (Makhija et al, 2018); however, there is little published information regarding its impact in real clinical situations.

Remote monitoring of PD patients' blood pressure and weight has been shown to be acceptable and associated positively with increased feelings of autonomy and confidence (Magnus et al, 2017). Cafazzo et al (2010) found patients to have fewer perceived barriers, such as anxiety and lack of self-efficacy, when remote monitoring was introduced to a home haemodialysis programme. Furthermore, a study of 47 PD patients, 25 of whom had videoconferencing installed in their home, found that 2% of teleconsultations triggered a hospital visit, and patients in the teleconsultation group required fewer hospital days than the comparison group (Gallar et al, 2007). However, selection bias may have contributed to the results, and other studies suggest that telemedicine's impacts can be complex and unpredictable. For example, Lew et al (2018) found it to be associated with both increased and reduced attendances and admissions, depending on participants' sub-group.

A very recently published retrospective case-controlled Italian study examined the utility of a bi-directional RPM APD system. It found that clinicians utilised the system to make more proactive adjustments of dialysis prescriptions for the patients on RPM than those on standard APD, resulting in fewer clinic visits for RPM patients in their first six months of therapy, but not once established. Reassuringly, it also showed the RPM system to be as good as standard APD for dialysis adequacy and maintenance of biochemical parameters, though its timescale was insufficient to assess outcomes such as morbidity, mortality or technique failure (Milan Manani et al, 2018).

Aim

Baxter Healthcare commissioned a wide-ranging evaluation of the impact of Claria Sharesource in the UK units that first adopted the new system. The aim of this article is to discuss the findings relating to clinicians' and patients' experiences of Claria Sharesource and its impact on the working activities of PD nurses, particularly whether they made more proactive and fewer reactive therapy interventions, and whether they spent more time conducting 'higher valued' tasks.

Methodology

Data were collected through three processes: longitudinal observations, an online questionnaire and telephone interviews.

Longitudinal observations

A tool was designed to log the time PD nurses spend on different types of task, specifically whether the task is proactive (anticipatory, preventative and change oriented, such as clinician discussions, phone calls/visits to patients and reviewing daily dialysis records), reactive (responsive, such as urgent patient consultations and assessments) or routine (regular planned activities, such as scheduled line changes and review consultations). PD nurses were observed and their behaviour logged throughout their working day on two occasions: once between July 2015 and July 2016 (before the introduction of Claria Sharesource) and once between September 2016 and March 2017 (6–13 months after Claria Sharesource was established).

'Valued' activities

The activities that PD nurses perform that can directly influence patients were identified and grouped into eight clusters from the job description of a band 7 PD nurse. Patients were asked to rate each cluster out of 10, and the PD nurses were asked to weight 80 points across the 8 clusters, to show how much those activities help patients to feel confident and safe using their PD at home. The means score for each cluster was multiplied to give a value for that patient activity (see *Table 4*).

Questionnaire

PD nurses were asked to complete an online questionnaire, once before their unit introduced Claria Sharesource and once again afterwards. Both pre- and post-implementation questionnaires gathered information around time management, logistics, support, and satisfaction with patients' APD. The pre-implementation questionnaire also gathered data around the perceived relative values of nurse activities.

Interviews

Structured interviews were conducted by phone. Patients and nurses were interviewed both pre- and post-introduction of Claria Sharesource, but doctors were only interviewed afterwards, as it was felt they have a more holistic view of unit-wide impacts. All interviews gathered information about the logistics of and satisfaction with the APD system in use at that time. The initial patient interviews also gathered data around the perceived relative values of nurse activities.

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Table 1. Nurse and medic participant information	Nurse pre-device online questionnaire	Nurse post-device online questionnaire	Post-device medic phone interview
Number of participants	25	17	7
Number of units represented	14	10	7
Mean number of APD patients in unit	61.3	51.5	44
Minimum and maximum number of APD patients currently in unit	10–210	11–162	21–100
Mean number of patients using new Homechoice Claria	n/a	31.4	36.71
Minimum and maximum number of patients using new Homechoice Claria	n/a	5–105	10–98

Table 2. Patient participant information	Initial interviews	Interviews after units adopted Claria Sharesource
Number on standard APD	19	6
Time on standard APD (months)	Range 0-57, mean 24.9	Range 15-64, mean 33.6
Number on Claria Sharesource	0	13
Time on Claria Sharesource (months)	n/a	Range 3-10 months, mean 6.2
Gender		Female 53.8%, Male 46.2%
Age		Range 40–80 years, mean 63.4
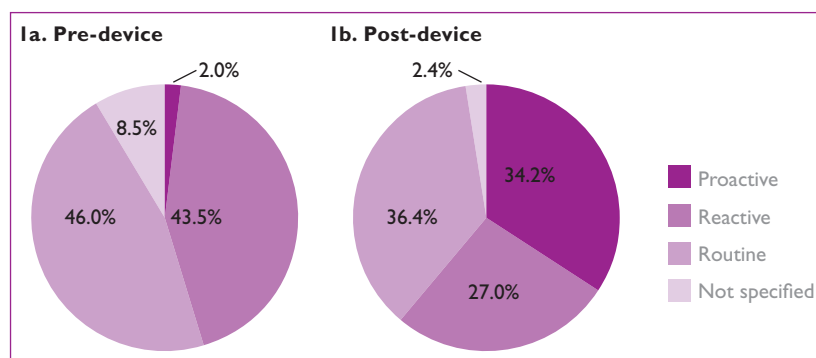
Figure 1. Percentage of time spent on proactive, reactive and routine activity pre- and post-Claria Sharesource

Sampling

Renal units were eligible to participate if they had agreed to switch to Claria Sharesource but not actually started to switch. Territory managers approached individual PD nurses to observe and interview through convenience sampling. All PD nurses at the eligible units were invited to participate in the online questionnaire. Patients who participated in interviews were identified and approached by nurses.

Ethical approval

As the project was an evaluation of a service, not a research study, formal ethical approval was not required. All participants were given written information about the study, gave written consent, and were free to withdraw at any time.

Results

Seven nurses from seven different units took part in the pre-device observations, but three were removed from the data set, as their units took on insufficient Claria Sharesource patients for the post-device observations to be conducted. A total of 47.25 hours of nursing time were analysed. A total of 25 nurses from 14 units completed questionnaires pre-device and 17 from 10 units completed post-device questionnaires, at which time the mean number of patients using Claria Sharesource in each unit was 31. Seven medics from seven units participated in interviews (Table 1). A total of 19 patients participated in both pre- and post-device interviews, 13 of whom switched to Claria Sharesource between interviews (Table 2).

Proactive, reactive and routine activities

Initial observations showed that only 2% of nursing time was spent on proactive tasks (Figure 1a). Comments from nurses in their initial interviews give some indications of why the distance between renal unit and patients' homes impedes proactive management of standard APD:

'Reliant on patient relaying information or accessing SIM card to see how treatment is going.' (Nurse)

'Hard to monitor without visiting each patient.' (Nurse)

'Patient input error if making remote changes over the phone.' (Nurse)

'Unable to see the program or remotely change the program.' (Nurse)

One nurse made explicit some of the negative impacts of this:

'Unexpected emergency clinic visits, delayed assessment of complications/increased hospitalisations.' (Nurse)

After implementation of Claria Sharesource, time on proactive tasks increased to 34%, while time spent on reactive activity dropped from 43.5% to 27% (Figures 1a and 1b). This was accompanied by an increase in the frequency with which nurses reviewed patients' dialysis data. After the introduction of Claria Sharesource, 68.8% of nurses reported remotely reviewing patients' dialysis data daily, and none less frequently than once per week (Figure 2). The timeliness and convenience of this was commented on by both clinicians and patients:

'24-hour turnaround of data.' (Patient)

'Improved communication and readily available data.' (Nurse)

'Close monitoring of the patient when first set up. Close monitor of patient when PD prescription has been changed. Close monitoring of patient when experiencing alarms and being able to try and route cause.' (Nurse)

All participant groups felt that Claria Sharesource enabled earlier identification and remedial action of dialysis issues:

'Spot issues with dialysis sooner, able to change prescriptions remotely.' (Nurse)

'Earlier detection of overload and dehydration.' (Nurse)

'Hospital can see information. Flag up problems a lot sooner rather than waiting 2–3 months.' (Patient)

'Early action for adherence and intervention of problems.' (Doctor)

Time spent on routine activity dropped from 46% to 36.4% (Figure 1). This was accompanied by a fall in the mean number of routine visits per year reported by patients from 6.46 to 4.3 and mean reported clinic visit length falling from 55 to 34 minutes.

Satisfaction

When asked to rate on a scale of 1 to 10 their satisfaction with Claria Sharesource, doctors gave a mean rating of 7.75 and nurses 8.29, up from 7.3

Table 3. Mean ratings of satisfaction with dialysis service		
Participant group	Standard APD prior to introduction of Claria Sharesource	Post-introduction of Claria Sharesource
Patients: how would you rate your level of satisfaction with your current dialysis device? 1=extremely dissatisfied, 10=extremely satisfied	N/A	9.15 (patients who switched to Claria Sharesource) 9.67 (patients who remained on standard APA)
PD Nurses: how would you rate your level of satisfaction with your patients' current dialysis device? 1=extremely dissatisfied, 10=extremely satisfied	7.32	8.29
Medics: how would you rate your level of satisfaction with your patients' current dialysis device? 1=extremely dissatisfied, 10=extremely satisfied	n/a	7.75

for standard APD. Patients appeared more satisfied than clinicians: patients' initial mean rating was 9.3, which remained almost as high at 9.15 for those who switched to Claria Sharesource but rose to 9.67 for those who remained on standard APD (Table 3).

Interviews revealed a number of reasons for high satisfaction (in addition to the ability to review remotely and act proactively, as previously described). Many found the system reassuring:

'New machine relays information make me feel safer that if anything is wrong I will be contacted.' (Patient)
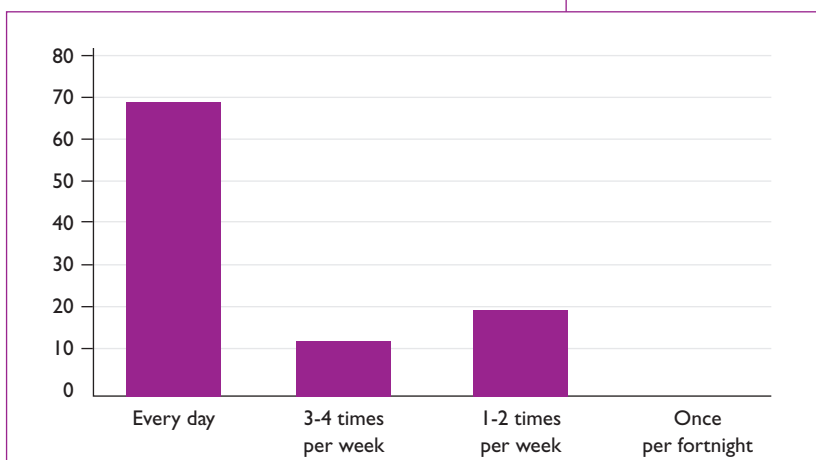
Figure 2. Frequency with which nurses review patients' online dialysis data through Claria Sharesource.

Table 4. Value of, and time spent on, activities that directly influence patients

Activity	Value of activity cluster for helping patients feel confident and safe using their peritoneal dialysis at home	Time observed con-ducting activities pre Claria Sharesource (mins/%)		Time observed con-ducting activities post Claria Sharesource (mins/%)	
		Minutes	% of total observed time (1422 minutes)	Minutes	% of total observed time (1413 minutes)
Train patients on how to use and/or manage their dialysis at home	129.8	32	2.3%	27	1.9%
Phone support for patients and/ or carers	123.7	136	9.6%	132	9.3%
Education for patients on condition and treatment and answer questions and concerns	97.2	0	0	0	0
Review patients' daily record book and/or test results to monitor how well dialysis is working	92.1	124	8.7%	114	8.1%
Discuss treatment options/ treatment plans/medication details with patients	82.1	180	12.7%	117	8.3%
Conduct patient examination to assess their condition	79.3	140	9.8%	30	2.1%
Establish patient history and feedback to assess their condition	55.4	122	8.6%	55	3.9%
Writing letters/emails to patients to help them with their dialysis at home	21.3	30	2.1%	35	2.5%
TOTAL	n/a	764	53.7%	510	36.1%

'Easier to manage, safer treatments, patients not so reluctant to dialyse at home.' (Nurse)

'They [patients] feel reassured.' (Nurse)

Participants also noted the benefits of reduced travelling, because prescriptions could be adjusted remotely:

'Above all, remote monitoring in patients living at a long distance.' (Doctor)

'Being able to view and alter without patient being at hospital.' (Nurse)

For some, however, satisfaction was impeded by teething problems:

'OK now it has all settled down. Had issues with alarms going off initially.' (Patient)

However, this is a problem common to all new PD patients, regardless of the type of software used. The noise of Claria Sharesource was a common complaint, for example:

'Noise keeping me awake at night. The other machine was quieter.' (Patient)

'Machine is noisier than the last one.' (Nurse)

Subsequent machine updates have, however, addressed this issue, and have resulted in a reduction in the noise emitted. Transmission issues were also noted by nurses:

'It can be slow and doesn't always download data.' (Nurse)

Other participants raised issues concerning lack of 'signal in countryside location[s]' (Nurse); however, boosters are provided to ensure that all patients have a capable internet connection.

Some clinicians had specific suggestions for improving the system:

'Snapshot screen would be preferred to include the initial drains as well as weight and total ultrafiltration.' (Nurse)

'Improve the information on the dashboard regarding ultrafiltration [values] (night, day); calculate peritoneal equilibration test [values], improve the prescribed treatment visualisation; allowing patient to introduce more parameters if desired, e.g. a second blood pressure value.' (Doctor)

Valued contact

Initial observations showed that 53.7% of nurses' time was spent on activities that can directly influence patients. This fell to 36.1% after introduction of Claria Sharesource (Table 4).

The four most highly valued activity clusters were:

- Training patients on how to use and/or how to manage their dialysis at home
- Phone support for patients and/or their carers
- Education for patients on condition and treatment and answering questions and concerns
- Reviewing patients' daily record book and/or test results to monitor how well the dialysis is working.

Time spent on these was not particularly affected by the introduction of Claria Sharesource (Table 4). Activity clusters that were considered less valuable included:

- Discussing treatment options and/or treatment plans and/or medication details with patients
- Conducting patient examination to assess their condition
- Establishing patient history and feedback to assess their condition.

Time spent on these activities reduced following introduction of Claria Sharesource. Time spent on the least valued activity cluster (sending letters or emails to patients to help them with their dialysis at home) was not affected (Table 4).

Discussion

The initial observation that 2% of nursing time was spent on proactive and 43.5% on reactive tasks starkly indicates how hard it is to pre-empt problems when patients perform standard APD at home. The introduction of Claria Sharesource gave clinicians the opportunity to directly examine information about the quantity and quality of dialysis that each individual patient had received in the previous 24 hours. Although time spent reviewing dialysis records remained steady, over two-thirds of nurses reported that they remotely reviewed patients' dialysis data every day. Clinicians commented that this enabled early identification of issues such as poor concordance or fluid removal/overload and both clinicians and patients remarked how reassuring this oversight was. As a result, the share of time spent on proactive activities increased to 34%. This correlates with the finding of Milan Manani et al (2018) that the prescriptions of patients using bidirectional RPM were modified more frequently than those on standard APD.

While proactive activity increased, reactive and routine activities fell. The activities which resulted in particularly noticeable drops involved assessing patients (physically or through history taking), which fell by two-thirds from 18.4% to 6%. It is assumed that this represents both fewer urgent reactive assessments of patients experiencing complications and less time on routine review of well patients, as patients reported a fall in the mean number of routine visits per year (from 6.46 to 4.3), and mean clinic visit length also fell (from 55 to 34 minutes).

This proactive method of working should be more efficient through the allocation of resources (such as home visits, phone calls and clinic consultations) towards those who have had poor dialysis. Preventing minor problems from becoming serious complications should reduce emergency attendances, admissions and therapy failure (Wallace et al, 2017). It is also hypothesised that less nursing time will be required to support PD patients, allowing growth of the PD population without additional staffing. However, these benefits remain theoretical until evidenced in studies that include evaluation of patient outcomes including but not limited to PD and patient survival, rates of peritonitis and other complications, adequacy, and resource utilisation. These may take the form of classic randomised controlled trials or analysis of data already gathered by the renal registry.

It is interesting that when asked to rate their level of satisfaction with current dialysis device, patients were very enthusiastic (scoring over 9 out of 10 at all points), but that the most satisfied group were those patients who had remained on standard APD, rather than switching to

Key points

- Peritoneal dialysis (PD) is an important therapy option for people with kidney disease. It is particularly valued because it is home-based, flexible, and allows patients to be largely autonomous
- However, some patients have anxieties about the safety of, or their ability to, perform their own therapy at home, without direct medical oversight
- The Claria Sharesource system allows clinicians to remotely monitor their patients in real time
- The results of this preliminary evaluation suggest that Claria Sharesource system changes the experience and actions of patients and clinicians, and that user satisfaction levels are generally high

CPD reflective questions

- What are the advantages and disadvantages of remote patient mointoring of patients undergoing peritoneal dialysis?
- Think of a patient who you care for. In what ways could their experience of peritoneal dialysis be improved through using the Claria Sharesource system?
- What reservations might some patients have towards being remotely monitored, and how could you address these concerns?

Claria Sharesource. Comments revealed issues with the noise and reliability of data transfer of Claria Sharesource. Subsequent machine updates have reduced noise; patients in areas with poor broadband connection are provided with boosters; and on occasions when broadband connection is lost, the treatment data downloads as soon as a connection is re-established. It is thought that these developments will address such concerns. Additionally, units are likely to have switched patients who were less concordant or struggling with PD onto Claria Sharesource to give greater support and insight into their needs. Therefore, those individuals who were not switched are likely to be those who were already coping well with good self-management, which may also have contributed to the results.

Existing literature reflects a widespread belief that RPM would lead to greater patient satisfaction, largely as a result of needing fewer routine appointments and the reassurance of increased oversight (Wallace et al, 2017), and these factors were apparent here. Interviews did not reveal patient dissatisfaction with reduced clinician contact, suggesting that this was either not noticed or felt to be a reasonable trade-off for more frequent clinician review of dialysis data. It must be noted that nurse satisfaction rose (from 7.3 to 8.29) after introduction of Claria Sharesource, suggesting that nurses preferred the new system, and that the patient satisfaction rating of 9.15 is very positive.

The differences in the patient satisfaction from the Sharesource switch group (13) and those starting on Homechoice Pro (6) after being on treatment for more than 6 months is not statistically significant. The difference is more likely to be explained by standard error of the two sample groups. The difference with the nurse satisfaction score is on average every nurse scoring Sharesource one satisfaction point higher. Given the number of nurses involved in this study, this translates as a definite difference. On the other hand, the difference with the patients is one patient only scoring one satisfaction point higher in the Homechoice group compared with the Sharesource group, which indicates just a difference in the two groups of patients. Adequately powered quantitative studies and rigorous analysis of appropriately gathered qualitative data will unpick and clarify these issues, allowing more firm conclusions to be drawn and the further optimisation of RPM systems for people on PD.

Conclusion

This preliminary evaluation provides evidence that Claria Sharesource APD system changes the experience and actions of patients and clinicians and that user satisfaction levels are generally high. This technology has the potential to bring wide-ranging benefits; however, it is important to consider that its impacts may be complex and not entirely as expected. There is a need for either randomised-controlled trials or large, observational registry studies to ascertain its impacts over the long term for patients and renal services, and for qualitative researchers to comprehensively explore user experience so that APD systems can be improved further.

Conflict of interests: Kate McCarthy is Medical Scientific Liason for Baxter Healthcare Limited.

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