

## Use of SMS and tablet computer improves the electronic collection of elective orthopaedic patient reported outcome measures

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### ABSTRACT

**INTRODUCTION** Electronic patient reported outcome measures (PROMs) enable real time reporting back to the patient and medical team, comparison between similar patient cohorts and long-term cost effective outcome measurement. The primary objective of this three-phase pilot study was to measure uptake using a web-based PROM system following the introduction of two separate process improvements.

**METHODS** Eighty consecutive new elective orthopaedic patients in a single surgeon's practice were recruited for the study. Patients in Group 1 ( $n=26$ ) received only a letter reminding them to complete a symptom score. Those in Group 2 ( $n=31$ ) also received a reminder SMS (short message service) message via their mobile or home telephone and those in Group 3 ( $n=23$ ) also had access to a tablet computer in clinic.

**RESULTS** The mean patient age in Group 1 was 55 years (range: 24–80 years), in Group 2 it was 60 years (range: 23–85 years) and in Group 3 it was 58 years (range: 37–78 years) ( $p>0.05$ ). Overall, 79% of patients had internet access, and 35% of Group 1, 55% of Group 2 and 74% of Group 3 recorded an electronic PROM score ( $p=0.02$ ). In Group 3, 94% of patients listed for an operation completed an electronic PROM score ( $p=0.006$ ).

**CONCLUSIONS** Collecting PROM data effectively in everyday clinical practice is challenging. Electronic collection should meet that challenge and improve healthcare delivery but it is in its infancy. This pilot study shows that the combination of an SMS reminder and access to a Wi-Fi enabled tablet computer in the clinic setting enabled 94% of patients listed for an operation to complete a score on a web-based clinical outcomes system. Additional staff training and telephone call reminders may further improve uptake.

### KEYWORDS

Outcome assessment – Data collection – Computers – Text messaging – Orthopaedics

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Patient reported outcome measures (PROMs) are standard question sets, developed with input from patients, that use the scores from individual questions (items) together, usually summed, to produce an overall score that represents a particular underlying construct or domain. Condition specific and generic wellbeing PROM scores have traditionally been used to evaluate the impact of healthcare interventions across a wide range of chronic medical and surgical conditions.<sup>1–6</sup> Instituted in 2009, the National PROMs Programme (NPP) collects data for four surgical procedures (elective hip and knee replacement, varicose vein surgery and hernia repair),<sup>7</sup> with scores being recorded using pen and paper once preoperatively and once postoperatively. The process is administered for approximately £5.30 per patient with a delay of 19 months before finalised aggregated data are made available to clinicians. Furthermore, at present, patients are unable to access or make use of their own data.<sup>8</sup>

Collection of electronic PROMs (ePROMs) on a suitable web-based system may enable patients and their medical teams to make use of such clinical outcome data while it is clinically relevant. Patients can potentially compare themselves with similar patients; both patients and doctors can track symptom scores before and after treatment as well as in the long term. Such ePROM systems can provide higher patient acceptance, lower administrative burden, shorter system delay, fewer secondary data entry errors, and a more accurate and more complete dataset.<sup>9,10</sup> Previous concerns over ePROM collection have centred on the ability to capture all sections of the population, with potentially limited internet access and familiarity in the elderly demographic.<sup>9</sup>

The aim of this three-group observational study was to assess different methods of improving uptake of ePROM data on the web-based system in use at our National Health Service (NHS) trust.<sup>11</sup> The three methods compared were sending a reminder letter before clinic, sending a

reminder SMS (short message service) before clinic and using a tablet computer during clinic.

## Methods

This was a non-randomised pilot study that recruited 87 consecutive new patients referred to a single orthopaedic surgeon, who has an interest in hip and knee arthroplasty, over a six-month period at a UK district general hospital. Seven patients who were not contactable by telephone were excluded from the study, leaving a total of eighty patients.

Patients from the first two months formed Group 1, those from the next two months formed Group 2 and those from the final two months formed Group 3. New patients were asked to register on the web-based system, using any available internet connection and computer, and to complete a set of condition specific and generic wellbeing PROM scores. Patients with a hip problem completed the Oxford hip score and the howRU™ score while patients with a knee problem completed the Oxford knee score and the howRU™ score.<sup>12–14</sup> The howRU score is a generic wellbeing score, validated against the SF-12® (Short Form 12-item health survey) score, that rates four items ('pain and discomfort', 'feeling low or worried', 'limited in what you can do' and 'requiring help from others') to provide a score from 0 (low wellbeing) to 12 (high wellbeing).<sup>15</sup>

Patient demographic details revealed that the overall mean age was 57 years (with no significant age difference between the groups) and that 75% of patients in the study had access to the internet (Table 1). All patients received a leaflet in clinic, encouraging them to register a score and read additional information (provided by NHS Choices) about their condition on the web-based system. Additionally, Group 1 patients received the following brief invitation on their clinic appointment letter:

*'We are asking all of our patients to register and complete a symptom score on [www.myclinicaloutcomes.co.uk](http://www.myclinicaloutcomes.co.uk). Please ask a close friend or relative to help with internet access if necessary and click on the 'contact us' tab on the front page of the website if you have any questions.'*

Further to the invitation on the clinic appointment letter, patients in Group 2 also received a reminder SMS. The SMS was sent three days before the appointment to the contact numbers provided on the hospital electronic record, either to the mobile number, landline number or both. Mobile telephones received the SMS as a text message whereas landline telephones received the SMS as an automated voice message. A delivery report was recorded and patients were asked at clinic or via a follow-up telephone call whether they had received the SMS reminder.

Group 3 patients received the letter and an SMS reminder, and they were also offered access to the internet in the outpatient department via a tablet computer, allowing them to register a score using the hospital wireless (Wi-Fi) network. There was no obligation to register on the system and nursing staff were available during most clinics to help patients with recording their score.

All ePROM data were recorded prospectively on the myClinicalOutcomes web-based system and statistical analysis was performed using Excel® (Microsoft, Redmond, WA, US). Chi-squared tests were performed for a null hypothesis of no difference between the groups. One-way analysis of variance and chi-squared tests were used to assess for a significant difference in age and distribution of landline/mobile numbers between the groups (as potential confounding variables). A  $p$ -value of  $<0.05$  was deemed statistically significant.

## Results

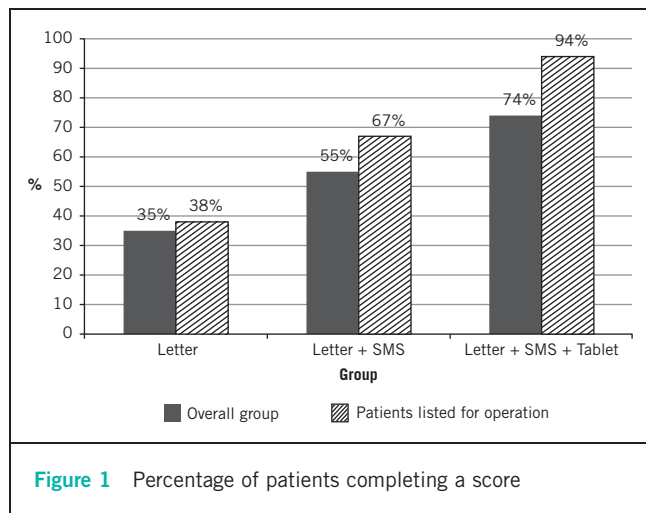
Nine patients (35%) in Group 1, seventeen (55%) in Group 2 and seventeen (74%) in Group 3 completed a score ( $p=0.02$ ) (Table 1 and Fig 1). Of those patients who were listed for an operation, five (38%) in Group 1, ten (67%) in Group 2 and fifteen (94%) in Group 3 completed a score ( $p=0.006$ ). From those patients not listed for a procedure, four (31%) in Group 1, seven (44%) in Group 2 and two (29%) in Group 3 completed a score ( $p=0.69$ ).

In Groups 2 and 3, an SMS was sent to 12 patients (22%) with mobile numbers only, to 32 (59%) with landline numbers only, and to 10 (19%) with both mobile and landline numbers. There were no significant differences in distribution between the groups ( $p=0.148$ ). SMS delivery failed for

**Table 1** Patient demographic details, access to the internet and score completion rates

Group	Intervention	<i>n</i>	Mean age	Age range	Male-to-female ratio	Internet access	Score completed	Patients listed for surgery	Score completed	Patients not listed for surgery	Score completed
1	Letter only	26	54.6*	24–80	15:11	73%	9 (35%) <sup>†</sup>	13	5 (38%) <sup>‡</sup>	13	4 (31%) <sup>§</sup>
2	+ SMS	31	59.5*	23–85	14:17	77%	17 (55%) <sup>†</sup>	15	10 (67%) <sup>‡</sup>	16	7 (44%) <sup>§</sup>
3	+ tablet computer	23	57.7*	37–78	11:12	87%	17 (74%) <sup>†</sup>	16	15 (94%) <sup>‡</sup>	7	2 (29%) <sup>§</sup>
<b>Total</b>		<b>80</b>	<b>57.4</b>	<b>23–85</b>	<b>40:40</b>	<b>79%</b>	<b>43 (54%)</b>	<b>44</b>	<b>30 (68%)</b>	<b>36</b>	<b>13 (36%)</b>

\* $p=0.47$  (one-way analysis of variance); <sup>†</sup> $p=0.02$ ; <sup>‡</sup> $p=0.006$ ; <sup>§</sup> $p=0.69$   
SMS = Short Message Service



two patients with a landline number and for one patient with both numbers available. Four patients (40%) who had an SMS reminder that was confirmed as delivered to their mobile number could not recall receiving an SMS. The same was true of 15 patients (45%) with a landline number and 2 (18%) for whom both mobile and landline numbers were available. Accordingly, overall, 19 patients (37%) denied receiving an SMS that was confirmed as delivered.

## Discussion

The use of PROMs in the NHS is set to increase. Successive Department of Health papers have signalled a shift away from a target driven culture towards one focused on quality health outcomes.<sup>15,16</sup> There is a growing trend towards improved patient involvement in assessing and managing illness, and plans exist to extend the NPP beyond the current four procedures to include all chronic conditions.<sup>17</sup> Information technology will be important in minimising the time and cost of collection, analysis and presentation of data.<sup>8</sup>

Joint replacement patients are a more elderly demographic, with the mean age for primary hip replacement at 67.2 years (interquartile range: 62.0–76.7 years) and primary knee replacement at 67.4 years (interquartile range: 63.2–76.5 years).<sup>18</sup> Concerns have been raised regarding ePROM collection in this cohort.<sup>6</sup> The Office for National Statistics estimates overall internet penetrance in the UK at 83%.<sup>19</sup> Internet access in our cohort of patients was 79%. With a mean age of 57 years, this is similar to the quoted UK internet penetrance rate of 75% in the 55–64 year age group.

While UK penetrance currently drops to 27% in people aged >75 years,<sup>20</sup> access in the 65–74 year age group has risen from 51% to 64% over the last 3 years.<sup>20,21</sup> This group will form the older range of elective orthopaedic patients over the next ten years, enabling a strategy that includes ePROM collection to potentially succeed in this demographic group.

Several other papers have looked at the collection of ePROMs in clinic using a tablet computer or a web-based system and many more have discussed the logistical challenges of using ePROMs in clinical practice.<sup>5,22–26</sup> This pilot study was limited by its single surgeon, single centre study design as it was not possible to randomise or blind either the subjects or the observers. Furthermore, the small numbers studied do not allow the effects of differences in mobile phone usage or internet access to be determined. There are, however, only very few papers in the literature studying the processes required to optimise patient uptake of ePROMs in everyday clinical practice.<sup>9</sup>

Reminder SMS messages were effective at increasing uptake to the ePROM system. Mobile phone use and text message communication is increasing both among the younger<sup>20</sup> and more elderly<sup>27</sup> population. In the UK, mobile use among senior citizens increased from 49% to 70% between 2005 and 2011.<sup>27</sup> Only landline numbers were available from the hospital records for most study participants and these trends suggest that mobile phone numbers, especially for elderly patients, should be recorded by hospitals routinely.

Healthcare providers should also develop strategies that include the increasing use of digital devices across all age groups. Introducing comprehensive staff access to Wi-Fi internet throughout the hospital network is an important step and should, in our opinion, be mandated across the entire NHS hospital network as a practical step to enable the information revolution to take hold.<sup>28</sup> At our hospital trust, Wi-Fi has allowed the use of a tablet computer in the outpatient clinic and will be essential for the success of our future ePROM strategy.

In October 2012 the NPP moved responsibility from a centrally commissioned single supplier to individual hospital trusts who pay for PROM collection from a choice of four framework suppliers. These suppliers either provide the whole PROM collection service or should accept locally collected data in electronic format (such as those data collected using the system in this study). From the most recently available finalised data, 116,734 linked records were collected from a total of 247,699 eligible procedures in the 12 months up to March 2012, a compliance rate of 47.1%.<sup>8</sup> An important next step would be to ensure that a direct feed of locally collected ePROM data into the NPP is possible.

The next step for this work is to expand this pilot study to involve multiple surgeons, centres and specialties. Larger numbers of patients will allow more in-depth investigation of the impact of factors such as age, internet access and mobile device usage. Patients with conditions currently included in the NPP (such as varicose veins and hernias) and those with chronic conditions not included the NPP may well have different needs when it comes to ePROM collection. Details on uptake among those patients coming to clinic later in their treatment pathway, either in the early postoperative period or at long-term follow-up, will also require inclusion in future research. ‘Virtual’ follow-up of stable long-term conditions, making use of ePROMs in combination with x-ray films or blood results, may then be possible.

## Conclusions

This 'real world' pilot study demonstrates that improving the processes in place around the collection of ePROM data does improve the uptake of new elective hip and knee orthopaedic patients on to a web-based system. It suggests that concerns around uptake in the elderly may be somewhat addressed given the correct tools and support. The combination of an SMS reminder and access to a Wi-Fi tablet computer in the clinic setting enabled 94% of patients listed for an operation to complete a symptom score. A more comprehensive study is planned.

## Declaration of interest

Mr Dan Williams is co-founder of myClinicalOutcomes.

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