

BMJ Open Quality Is virtual clinic follow-up of hip and knee joint replacement acceptable to patients and clinicians? A sequential mixed methods evaluation

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ABSTRACT

Objective To evaluate the acceptability to key stakeholders of a newly introduced virtual clinic follow-up pathway for hip and knee joint replacement.

Design A service evaluation comprising a questionnaire sent electronically to 115 patients and interviews with 10 individuals.

Setting A newly introduced virtual clinic follow-up pathway for hip and knee replacement patients in a district general hospital.

Participants The electronic questionnaire was distributed to all patients treated under the virtual clinic service over a 5-month period (n=115). Purposive sampling from volunteers among respondents, leading to semi-structured interviews with eight patients. Two orthopaedic consultants were also interviewed.

Intervention Consultant review of web-based patient reported outcome measures and digital radiographs, with feedback to patients via letter, replacing face-to-face outpatient appointments for the follow-up of hip and knee joint replacement.

Results The response rate to the questionnaire was 40%. 44% indicated they would prefer a virtual appointment over a face-to-face consultation in future. The most common word in the free text comments was 'good' (n=107). Seven main themes were identified from the patient interviews: patient understanding and expectations, patient confidence, patient voice, managing deterioration of condition, patient benefit, patient satisfaction using technology and navigating the website. Two main themes were identified from the staff interviews: the adapting patient pathway and project management. Combined analysis elucidated that patients who were doing well liked the 'click and go' approach but those with problems were concerned about how to report these and were therefore less satisfied.

Conclusion The virtual clinic process appears to be well accepted by both patients and clinicians. However, appropriate patient selection and clear pathways of communication to address patient concerns are pivotal to success.

INTRODUCTION

A total of 101 651 hip replacements and 108 713 knee replacements were recorded in the UK in 2016 representing an increase of 3.5% and 3.8%, respectively compared with

the previous year.¹ This increase is reflected globally and is predicted to continue, precipitated by an ageing population and growing rates of obesity.^{2,3} One projection from the USA estimates increased rates of primary procedures of 174% and 673% for hip and knee joint replacements, respectively, between 2005 and 2030.⁴ Cost-effective and efficient follow-up is therefore required to keep pace with demand and to comply with evidence based national guidelines, for example, British Orthopaedic Association (BOA) guidance (see [table 1](#)).^{5,6} The National Institute for Health and Care Excellence are undertaking a consultation to explore the options for monitoring and surveillance, which may not necessarily require face-to-face appointments and can be undertaken remotely with clinicians reviewing radiographs and validated Oxford pain and function scores.^{1,7}

Virtual clinics appear to be gaining popularity and in various forms have been applied across many specialties and contexts but concerns remain around both logistical and technical issues, and acceptability to patients and staff.⁸ In 2014, with support from the Health Foundation (Shine initiative), the orthopaedic team at our district hospital introduced a virtual clinic model for the follow-up of hip and knee joint replacement. Here the acceptability to patients and consultants is evaluated.

PARTICIPANTS AND METHODS

The clinic

The virtual clinic involved the treating consultant reviewing up-to-date radiographs and the trends in validated patient reported outcome measures (PROMs), using the My Clinical Outcomes (MCO) web-based system, at the intervals set down by the BOA ([table 1](#)).^{9,10}

To achieve this the MCO platform is automated to request completion of PROMs by

Table 1 British Orthopaedic Association advised follow-up^{5 6}

Patient group	Implant rating	Follow-up timeline	Follow-up content
All	All	≤6 weeks	Seen and given feedback about treatment
Hip replacement >75 years	ODEP 10A	No further routine follow-up required	
Hip replacement <75 years	ODEP 10A	1 year, 7 years and 3 yearly thereafter (if asymptomatic)	► Telephone or web-based PROMs.
	Novel implants	Yearly for 5 years, 2 yearly until 10 years then 3 yearly	► Radiographs, reported by a radiologist with musculoskeletal interest.
Knee replacement	Established implants	1 year, 7 years and 3 yearly thereafter (if asymptomatic)	
	Novel implants	Yearly for 5 years, 2 yearly until 10 years then 3 yearly	

PROMs, patient reported outcome measures. ODEP, orthopaedic data evaluation panel rating

patients at 3-month intervals and patients are also invited to attend for an X-ray appointment at their local hospital.

The outcome of the clinic is relayed to the patient and their general practitioner via letter and can result in ongoing virtual clinic monitoring or recall for face-to-face review.

Patients were recruited to the virtual clinic either preoperatively or at a face-to-face follow-up by the clinical team and were supported in completing the process by an administrator.

The study

A sequential mixed methods evaluation was performed. Data were collected using a questionnaire followed by semi-structured interviews.

All patients had completed at least one follow-up appointment for their hip or knee joint replacement, using the virtual clinic pathway.

Questionnaire

The questionnaire was initially piloted being sent to 70 patients, 29 returning responses in a group treated prior to February 2015. It was then administered formally with all patients (n=115) reviewed through the virtual clinic over a 5-month period (February–June 2015) being invited, via email, to complete an online questionnaire (online supplementary appendix 1), using SurveyMonkey, about their experience.¹¹ The questionnaire was available online for 1 month. Demographic information was collected and a mixture of Likert-based questions and free text responses were used to assess experience; a final question asked for consent to further contact.

Interviews

Patients

A sub-sample of eight people (among 15 volunteers) were purposively selected based on age, employment status, education and satisfaction of the virtual clinic experience. The topic guide (online supplementary appendix 2) included questions about expectations of using the virtual clinic, experience of the virtual clinic pathway,

what was liked and disliked about the service and any recommendations for future development. All interviews were recorded using an Olympus recording device and transcribed for analysis.

Consultants

To provide a fuller appreciation of the obstacles and benefits it was felt important to also explore consultants' views. Two out of three consultants approached agreed to audio-recorded face-to-face interview. A topic guide (online supplementary appendix 3) included: experience of the introduction and training on using the virtual clinic web-based platform, expectations and experience of following-up patients using the virtual clinic, barriers and facilitators to using the service, and recommendations for future implementation.

Ethics

This study was carried out as a service evaluation and therefore did not require formal ethical review.

Data analysis

A hybrid between explanatory and convergent methods was used. Preliminary results of the questionnaires were used to inform development of the topic card to confirm relevant areas were being discussed and therefore elaborated (explanatory element). However, all three data sources were analysed independently and then combined in a side-by-side joint display (convergent).

All patient data was anonymised and every effort was made to anonymise staff.

The questionnaire results were analysed in Microsoft Excel and NVivo V.12 was also used to perform a word frequency analysis of the free text comments (including stemmed words).

All interviews were transcribed using UK transcription services following a confidentiality agreement. Analysis of the interviews was conducted independently by the two qualitative researchers (JP and JW) and once completed, agreement was reached through discussion. A simple descriptive thematic analysis was performed with each

transcript read a minimum of three times prior to coding. Extracts of the transcripts were coded; codes with similar meaning were allocated to categories before the final descriptive themes were identified.¹² This resulted in an overall descriptive thematic synthesis which produced the final overarching themes. The qualitative interview data was treated as the dominant method and the themes were used as domains under which the results of the interviews and questionnaire findings were synthesised (Qual-Quant).

RESULTS

Online questionnaire

Of the patients approached (n=115) to give their views of the virtual clinic service, 40% (n=46) responded to at least part of the online questionnaire. Those responding represented a wide age range (mode 60–70 years). Fifty-one per cent of respondents were male (n=18), 31% (n=11) were in employment and 65% (n=23) were retired (see table 2 for demographics).

Several patients indicated they had had three or more virtual clinic follow-up appointments which would not have been consistent with the period the clinic had been running raising concern that patients may not be using the same definition as those providing the clinic. Radiographs were undertaken at a variety of hospitals and many indicated they had made savings. The most common free text word was 'good' (n=107) but several comments indicated a degree of disquiet among some individuals, requiring further elucidation. For full results see online supplementary appendix 4 and figure 1.

Patient interviews

In total there were seven interviews conducted face-to-face or by telephone, three participants were female, three were male and there was one husband and wife team. The interviews lasted between 8 and 25 min.

The following age categories were represented: 50–60 years, 60–70 years and 70–80 years. There were two people still in employment with the rest being retired, some participants had undergone formal education such as college or university and one person had not undertaken any further education after leaving school. Seven main themes were identified: patient understanding and expectations, patient confidence, patient voice, managing deterioration of condition, patient benefit, patient satisfaction, using technology and navigating the website. These themes/domains are analysed alongside the other two data sources in table 3.

Clinician interviews

Two consultant clinicians were interviewed. Two main themes were identified from the data. These are the adapting patient pathway and project management.

Consultants highlighted that prior to the introduction of the virtual clinics, they had autonomy to determine follow-up patterns. They recognised that although this had enabled patient focused practice there may be efficiencies

Table 2 Demographic breakdown of patients responding to online survey

Socio-demographic factor	Participants (n=76)	Percentage*
Gender		
Male	18	51
Female	17	34
Age		
<40 years	0	0
40–50 years	2	6
50–60 years	6	17
60–70 years	17	49
70–80 years	10	29
>80 years	0	0
Employment Status		
Employed/self employed	11	31
Retired	23	65
Student	0	0
Unemployed	0	0
Note added: semi-retired	1	3
Educational level		
School only	15	44
College/training /apprenticeship	11	32
University	8	24
Site of online access		
Home	43	93
Work	2	4
At a friend/relative's house	1	2
Other	0	0
Number of virtual clinic follow-up appointments		
1	26	54
2	9	20
3	4	9
>3	8	17
Ethnicity		
White British	34	97
Other (Cornish)	1	3
Difficulty communicating in English		
Yes	1	3
No	34	97

*Percentages are calculated based on only those who responded to that question.

to be gained by streamlining services. Cautious initial patient selection was discussed and it was voiced that as few as 10% of patients may be suitable. However, there were concerns that with the recommended frequency of follow-up even with adopting a virtual clinic pathway



Figure 1 Word cloud of free text responses from patient questionnaire.

the workload may prove unmanageable. This workload perception could represent either a driver for, or barrier to, change.

There was also suggestion of another barrier to change within the department in the form of fear of conflict of interest:

"My underlying feeling was that because this was Dan's business there was a little bit of antagonism"

Summary of main findings

Patients found the virtual clinic relatively easy to engage with and some found it helpful in self-management. Preference for face-to-face appointments appears multi-factorial, possibly dependent on past experience and personal circumstances. Frustrations with the virtual clinic surrounded the restrictive nature of using scoring systems and concerns over how best to report concerns and deterioration between appointed review points. In order for the patient voice to be successfully heard it must be clear that the consultants have responded to any issue raised. Indeed, the key theme underpinning all the others is patient voice. Satisfaction is very closely tied to knowing you are heard and it is in times of deterioration that this is most crucial, while understanding the process and mastering the technology and other benefits simply facilitate this.

Consultants raised concerns about workload management and appropriate identification of suitable patients for the virtual clinic pathway. No harm was identified from the introduction of the virtual clinic, in either direct questioning in the interviews or through the free text question asking about difficulties and concerns in the questionnaire (see online supplementary appendix 4 Q15). However, a clear strategy is needed to balance the service needs with the needs of the patients to inform future implementation of virtual clinics.

DISCUSSION

Strengths and limitations

This is the first service evaluation that we are aware of which examines the experience and perceptions in moving from a traditional follow-up clinic to a virtual clinic pathway. The views of both patients and clinicians have been considered.

However, only patients who had used the virtual clinics pathway have been consulted. These patients had been screened for suitability and therefore were computer literate. However, many patients are not computer literate or do not have access to a computer. In addition, it is likely to be patients and staff who have engaged with the process that submit to interview and may not be a true representation of the wider population. Further it is not possible to elucidate which patients made comments in the questionnaire or whether they were later interviewed. Similarly, the sample is not large enough to allow for subgroup analysis of questionnaire results.

With interviewees being selected from those completing the questionnaire it has allowed for exploration in richness and depth including misunderstandings. However, all the data is from a similar time meaning that analysis of how attitudes evolve, as the service becomes established, remains unknown.

Only two clinicians were interviewed so the full spectrum of opinions is not captured. Other staff were impacted by the introduction of the virtual clinic pathway such as administrative staff and management but reporting on this is beyond the scope of this paper.

The context is that of a district general hospital covering a large rural area therefore, some benefits (eg, travel time saved) may not be generalisable to an urban setting.

Formal economic assessment is not addressed here. However, local commissioners have established an ongoing £45 tariff for virtual clinic appointments making the pathway sustainable. Between April 2017 and March 2018 there were a mean of 30 such appointments each month and the clinic remains ongoing.

Comparison with existing literature

National joint registry data indicates that the two most common reasons for revision in both hip and knee joint replacement are aseptic loosening and pain.¹³ Therefore, joint replacement follow-up processes need to encompass assessments that pick up both the symptomatic patient and those at risk of periprosthetic fracture as a result of osteolysis before they become symptomatic.² Loosening and polyethylene wear presents between 7 and 20 years postoperatively in 72.6% of total hip replacement and aseptic loosening is the main reason for late revision in knee replacement.^{14 15} A robust system is therefore required to follow-up patients in the longer term. A virtual clinic pathway allows for long-term monitoring, screening for symptomatic patients using web-based outcome scores and signs of asymptomatic loosening on interval X-ray films. Others have found a reduced administrative burden, high acceptance and potential cost savings

Table 3 Side-by-side joint display

Questionnaire	Patient interviews	Consultant interviews	Summary
Themes/Domains <ul style="list-style-type: none"> ▲ 44% recalled receiving written information about the clinic process following the initial contact. ▲ 89% of these felt that the information was easy to understand and use. ▲ Two patients disagreed, one commenting: <i>"the technicalities involved were difficult to understand unless I had some medical knowledge. Needed to look up some details to clarify"</i> ▲ 26% of patients reporting having had three or more virtual clinic follow-up appointments (not consistent with the period the pathway had been available). ▲ One comment was made: <i>"I don't understand the term 'virtual clinic' If you use totally different descriptions of the same assessment you will confuse people"</i> 	Patient understanding and expectations <ul style="list-style-type: none"> ▲ All demonstrated a clear understanding that the virtual clinic pathway replaced a face-to-face outpatient appointment, following their joint replacement. ▲ All were familiar with the term virtual clinic: <i>"it is done through X-ray and the clinical outcomes, the survey I did"</i> ▲ There was an expectation that consultants were reviewing each PROM as it was completed. ▲ There was confusion about the role of the administrator, consultant and secretary. The administrator is seen as someone who resolves the computer and/or process issues and the consultant and secretary are as independent of the process only dealing with clinical queries: <i>"I see the consultant and his secretary separate, I know that they are connected but I feel that the virtual clinic is something completely different and managed by different people"</i> 	Consultant interviews <ul style="list-style-type: none"> ▲ The effect on workload was not as simple as had been expressed to the patients. For instance, some consultants previously discharged patients at 3 months therefore this new system will increase follow-up workload. ▲ Concerns were raised regarding capacity and long-term management. If the virtual clinic pathway reflects the BOA guidance a consultant conducting 200 hip and knee replacements many 1000 follow-ups required, each year. <i>"It's a good way of following them up, but I think we are creating a problem for us in the future"</i> 	Summary <p>The questionnaire raised concerns that a significant minority were confused by the terminology, highlighting the need for consistency. While at interview patients were seen to have good understanding of the process. However, it was revealed that patients did not perceive the administrative and clinical team as a single unit. The addition of the consultant perspective revealed the virtual clinic rather than simply being a replacement for routine care was actually in some ways an additional service.</p>
Themes/Domains <ul style="list-style-type: none"> ▲ Clarity of the follow-up report was rated as acceptable by 95% of respondents with 67% rating it as good or higher. ▲ One comment was made about the communication received: <i>"Very clear and helpful letter."</i> ▲ Another comment hinted at lack of confidence in the process: <i>"no opportunity to check that everything was as it should be"</i> 	Patient confidence <ul style="list-style-type: none"> ▲ The patients had confidence on receipt of the letter informing them the consultant had reviewed their scores and X-ray that the process was working. ▲ This was further validated by prompt response and confirmation that their general practitioner had been kept informed. ▲ All patients found the letter to be informative and gave them the confidence to contact the department should their situation change. <i>"the fact he said, 'if you have a problem, ring my secretary' was really comforting"</i> ▲ Confidence in being able to contact the administrator with queries also emerged as important in the interviews. <i>"She talked me through it and that was very helpful and I think having a voice on the end of the phone, for that sort of thing, is an excellent idea"</i> 	<ul style="list-style-type: none"> ▲ Nil directly relevant to topic. 	<p>Patients need confidence that the processes are being managed and clinical oversight is in place. Interestingly it was the timely receipt of the clinic letter/report and the quality of its content that the interviews found as the chief determinant of the patient confidence in the process. It was therefore important that the majority of patients surveyed found the report clear. However, both aspects also showed that providing alternative contact options for reassurance are imperative.</p>
Themes/Domains <ul style="list-style-type: none"> ▲ Some patients expressed frustration in the free text, one comment said: <i>"black/white" system left no room for 'grey' areas ... We are still people and not machines!"</i> and another <i>"it's one-way"</i>. 	Patient voice <ul style="list-style-type: none"> ▲ Only one patient interviewed felt that they had a lack of choice about following the virtual clinic pathway as they reporting being told: <i>"there was no need to see the consultant"</i>. ▲ Patients saw the PROM as easy to understand but there were some frustrations in completing them. Some felt that they did not have a voice, the process was didactic, impersonal and lacked flexibility. <i>"if you don't fit into that you are not going to get the appraisal that relates to your problem"</i> ▲ There appeared to be a disconnect between the understanding of discomfort and pain. One patient did not recognise the discomfort she was experiencing could be expressed as being as low-level pain. Instead, she felt that the questionnaire was not relevant to her situation. Patients highlighted that in a face-to-face review such uncertainties can easily be addressed: <i>"if I had seen the surgeon and he'd asked me those questions, I'd have said, 'yes but ...'"</i> ▲ To rectify this there was a strong desire for an MCO comments box to explain a response. ▲ Patients who had other joint replacements wanted to communicate progress concerning and the inability to do so using the system caused frustration. For one patient reported that he was following the virtual clinic pathway for one hip replacement but was experiencing a problem with his previous hip replacement conducted by a different consultant. ▲ The arrangement worked really well for those patients who remained trouble free and they liked the 'straight-forward, 'click and go approach'. 	<ul style="list-style-type: none"> ▲ Nil directly relevant to topic. 	<p>Patients were recruited by various methods: email, telephone call or by post. Some comments in the questionnaire hinted at frustration with communication. Exploring this further at interview it seemed that this could largely be addressed by offering a comments box or alternative method of contact so that patients could communicate their uncertainties.</p>

Continued

Table 3 Continued

Themes/Domains	
<p>Managing deterioration of condition</p> <ul style="list-style-type: none"> ▲ The patients acknowledged and demonstrated self-management opportunities within the virtual clinic process. ▲ The tracking of scores over time graphically demonstrated progress or deterioration, thus enabling the patient to manage their physical condition, such as increasing pain medication or seeking physiotherapy support. ▲ Patients expected that if the scores were deteriorating over time this would be picked up by the consultant between virtual clinic appointments. ▲ There was some uncertainty how to report deterioration with some people unsure who to contact. ▲ The two patients fully cognisant of the pathway had both worked in healthcare. 	
<p>Patient benefit</p> <ul style="list-style-type: none"> ▲ Nil directly relevant to topic. 	
<p>Themes/Domains</p> <ul style="list-style-type: none"> ▲ Four (9%) respondents indicated that they felt their joint replacement was being followed up ineffectively. ▲ Two words that had relatively high frequency in the free text of the questionnaire were problems (n=28), questions (n=24) and issues (n=19). 	
<p>Themes/Domains</p> <ul style="list-style-type: none"> ▲ Radiographs were obtained widely across the county and 98% reported the scheduling as convenient. ▲ Most patients (91%) indicated the ease of setting up the follow-up appointment was either very good or good. ▲ Free text comments commonly included the words: time (n=97), saves (n=56), easy (n=24), money (n=21) and travel (n=22) suggesting such concerns/benefits were important to patients. ▲ 86% of respondents indicated they had made financial savings with the most frequently attributed category being travel costs (63%). ▲ One patient commented: "It saved the time of travelling to and waiting at the hospital" 	
<p>Themes/Domains</p> <ul style="list-style-type: none"> ▲ The questionnaire demonstrated the expected changes of patients choosing to use peripheral hospitals to have their radiographs. The process was reported as straight forward and both time and money saving. These findings were confirmed at interview. However, the it was only in the interviews that the benefit of self-management became evident. ▲ A further element was commented on by the consultants in that the follow-up would be available more long term than previously. 	
<p>Themes/Domains</p> <ul style="list-style-type: none"> ▲ The questionnaire had nearheard quite diverse opinions about whether the virtual clinic was better or worse than having a face-to face consultation. Exploring this in the interviews it depended how well the process had worked for them and whether they were worried about their joint that caused this division. ▲ Interestingly some were relatively altruistic wanting the consultants to spend time with those in need. 	
<p>Themes/Domains</p> <ul style="list-style-type: none"> ▲ Nil directly relevant to topic. 	
<p>Themes/Domains</p> <ul style="list-style-type: none"> ▲ Satisfaction depended on whether the process had worked for them and on delivery of person-centred care. ▲ From a functional point of view, such as using the computer and attending a local hospital for an X-ray, the system rated very highly. ▲ Even if computer problems existed, the way they were managed by the administrator was highly satisfactory to all. ▲ There was a comment of mild irritation when a problem needed to be resolved via the MCO website, such as password resets, as patients had to wait between 24 and 48 hours for a response. ▲ Patients who were doing well, appreciated the 'click and go' aspect that the virtual clinic offered. When asked how they rated the system: "On 100%, 100%". ▲ Several expressed a sense of satisfaction of being able to give something back to the system, in particular, acknowledging that the virtual clinic was freeing up the consultant's time to see those in need. ▲ Patients experiencing a concern were less satisfied with the removal of the personal face-to-face interaction: "People who are following up, mustn't persuade themselves they've got a patient now who is wholly satisfied" 	

Continued

Table 3 Continued

Themes/Domains		Using technology and navigating the website
▲▲	The majority (69%) accessed the website at home. Comparing the virtual clinic to a face-to-face appointment found it an easier process, while 9% found it harder. It took 70% of patients less than 10 min to register online and complete their assessments and no one took longer than 20 min.	▲▲ All interviewees were comfortable and competent users of technology. Some of the patients have expectations that in future the NHS will use more technology. "Brilliant idea"
▲	100% of patients gave a neutral or positive response when asked about the usability of the website.	▲▲ Most found the website easy to navigate to complete their scores. There were minor difficulties logging in, which were resolved. The patients appreciated the update reminders telling them they needed to complete their next score. They also all liked having the personal feedback via the graphs, over time.
		▲ One person would have liked to receive an acknowledgement from the website of a change in the scores but instead just got a generic thank you message.
		▲ One patient raised her concerns over security in general but not relating to this website specifically.
		▲ Patients are screened by clinicians and the administrator considering frailty, access to technology, computer skills and compatibility of internet browsers with the MCO platform. It was felt that more elderly patients were less likely to be suitable for virtual clinics. "A lot of patients are over 80. Some of them are absolutely fantastic and do it but they're a minority". The perceived proportion of patients suitable for virtual clinic was approximately 10%. Despite this relatively low proportion it was believed that this number was now rising as more people are becoming computer literate.
		▲ Concerns were raised around patients who needing assistance with using MCO. Perceived problems were the ethical questions of confidentiality (though necessitating third parties having access to the information) and that reporting may not be reliable. "Friends doing it, again, it's done once and it's never updated".
		▲ Most patients were able to access the web from home and many found the virtual process easier than attending a traditional clinic. The patient interviews pointed to specific technical difficulties and were generally positive about the technology. However, the consultant interview highlighted the need for appropriate patient selection and perception that this pathway is suitable only so a specific sub population of those undergoing joint replacement.

BOA, British Orthopaedic Association; MCO, My Clinical Outcomes; NHS, National Health Service; PROM, patient reported outcome measures.

associated with electronically captured PROM data.^{16 17} Patients' positive experiences of the online platform and the cost savings they have personally experienced potentially facilitated our local transition.

The barriers to change in the more elderly patients were highlighted in the consultant interviews with concern more widely that those over 80 years will not be able to use a virtual clinic and may be lost to follow-up if their health or cognition deteriorate. However, internet use in elderly age groups is increasing and follow-up in patients over the age of 75 years at operation is not required long term.⁵ Patients having a joint replacement over the age of 70 years have a lifetime risk of requiring revision of between 1% and 6% for hip and knee, respectively, compared with 29.6% and 35% in men aged 50–54 years.¹⁸ In the more elderly, frailer group of patients the symptomatic thresholds for revision surgery are likely to be higher reflected in less stringent requirements for follow-up.

Two studies have examined the introduction of virtual clinics for joint replacement follow-up using radiographs and web based questionnaires.² A Canadian virtual clinic pilot in a mixed cohort of 40 patients with a mean age of 40 years undergoing hip and knee replacement found that men were significantly more likely to agree to participate than women (p=0.010) and that those having hip replacements were less likely to engage than those having knee replacements (p=0.019). Patients experienced problems logging on (22.5%) and with case sensitive passwords (7.5%).¹⁹ Interestingly radiograph assessment was found to be significantly more thorough when performed independently of a face-to-face appointment.¹⁹ By working closely with MCO in the early stages these electronic issues proved less of an issue in our cohort helping to facilitate the change.

In the same region of Canada 256 patients with a mean age of 68 years (closer to the 'typical' patient) a hip or knee replacement were randomised to either virtual follow-up or usual care. In addition to completing PROMs and undergoing X-ray films patients were asked two questions. (1) Do you have any pain or symptoms in your replacement joint? (2) Do you have any problems in your other hip or knee? A face-to-face appointment was provided if patients answered 'yes' to either question. Fourteen per cent of those who declined to take part did so because they preferred to have a face-to-face consultation; 10% declined based on being symptomatic. Satisfaction while good was not as high as in the routine care group (although this was not quantified).²⁰

Our interviews also found satisfied patients who missed the personal touch of a face-to-face interaction. This may be related to the wider, still not fully appreciated, interactions of emotional and physical support affecting patient outcomes.²

Dual assessment of 599 patients in England by a face-to-face Arthroplasty Care Practitioner appointment and by remote surgeon review of X-ray film and paper-based PROMs showed good agreement between the outcomes.

However, some cases of 'potential problems' were not identified by the remote assessment.^{2,21} Both the patients and staff interviewed locally agreed with a recent review, that those with symptoms must have easy access to face-to-face review, at whatever stage these symptoms occur.² Virtual clinics potentially free up face-to-face clinic capacity to see those patients who need it most.

CONCLUSION

Although barriers to change were identified and areas of the process require refinement, the virtual clinic process appears to be well accepted by at least some selected patients and consultant clinicians. The 'click and go' format seems most suited to those patients who are not experiencing problems with their joint replacement. In developing such systems, it must be recognised that people value the personal interaction of face-to-face appointments and that clear pathways of communication are essential, especially when a problem or concern is identified. These findings align with the intention of virtual clinics to provide cost effective follow-up and face-to-face capacity for those patients that need it.

Contributors DHW clinically oversaw the study design and implementation of the new virtual clinic. JP and JW conducted the interviews and initial analysis. RJP undertook the wider analysis and wrote the paper with JP, JW and DHW all making contributions to the drafts and approving the final version.

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Competing interests DHW is co-founder of MCO. There are no other competing interests.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

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REFERENCES

- National Institute for Health and Clinical Excellence. NICE guideline: Hip, knee and shoulder joint replacement draft scope for consultation. 2018 <https://www.nice.org.uk/guidance/GID-NG10084/documents/draft-scope>
- Lovelock TM, Broughton NS. Follow-up after arthroplasty of the hip and knee: are we over-servicing or under-caring? *Bone Joint J* 2018;100-B:6–10.
- Cross M, Smith E, Hoy D, *et al*. The global burden of hip and knee osteoarthritis: estimates from the global burden of disease 2010 study. *Ann Rheum Dis* 2014;73:1323–30.
- Kurtz S, Ong K, Lau E, *et al*. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am* 2007;89:780–5.
- British Orthopaedic Association. Pain arising from the hip in adults – Commissioning guide. 2014 <https://www.boa.ac.uk/pro-practice/pain-arising-from-the-hip-in-adults-commissioning-guide/>
- Guide C. British Orthopaedic Association. Painful osteoarthritis of the knee. 2015 <http://www.boa.ac.uk/pro-practice/commissioning-guide-painful-osteoarthritis-knee/>
- British Hip Society. Primary total hip replacement: a guide to good practice. 2012 <https://www.britisshipsociety.com>
- Greenhalgh T, Vijayaraghavan S, Wherton J, *et al*. Virtual online consultations: advantages and limitations (VOCAL) study. *BMJ Open* 2016;6:e009388.
- Griffiths-Jones W, Norton MR, Fern ED, *et al*. The Equivalence of Remote Electronic and Paper Patient Reported Outcome (PRO) Collection. *J Arthroplasty* 2014;29:2136–9.
- Monitor Progress. My Clinical Outcomes. <http://www.myclinicaloutcomes.com>
- SurveyMonkey Inc. San Mateo, California, USA. www.surveymonkey.com
- Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;3:77–101.
- The NJR Editorial Board. 14th Annual Report 2017. National Joint Registry for England, Wales, Northern Ireland and the Isle of Man. 2017 <http://www.njrreports.org.uk>
- Wroblewski BM, Siney PD, Fleming PA. Charnley low-friction arthroplasty: survival patterns to 38 years. *J Bone Joint Surg Br* 2007;89:1015–8.
- Khan M, Osman K, Green G, *et al*. The epidemiology of failure in total knee arthroplasty: avoiding your next revision. *Bone Joint J* 2016;98-B:105–12.
- Coons SJ, Eremenco S, Lundy JJ, *et al*. PRO) Data Electronically: The Past, Present, and Promise of ePRO measurement in clinical trials. *The Patient* 2015;8:301–9.
- Jayaram PR, Bhattacharyya R, Jenkins PJ, *et al*. A new "virtual" patient pathway for the management of radial head and neck fractures. *J Shoulder Elbow Surg* 2014;23:297–301.
- Bayliss LE, Culliford D, Monk AP, *et al*. The effect of patient age at intervention on risk of implant revision after total replacement of the hip or knee: a population-based cohort study. *The Lancet* 2017;389:1424–30.
- Wood G, Naudie D, MacDonald S, *et al*. An electronic clinic for arthroplasty follow-up: a pilot study. *Can J Surg* 2011;54:381–6.
- Marsh JD, Bryant DM, MacDonald SJ, *et al*. Feasibility, effectiveness and costs associated with a web-based follow-up assessment following total joint arthroplasty. *J Arthroplasty* 2014;29:1723–8.
- Kingsbury SR, Dube B, Thomas CM, *et al*. Is a questionnaire and radiograph-based follow-up model for patients with primary hip and knee arthroplasty a viable alternative to traditional regular outpatient follow-up clinic? *Bone Joint J* 2016;98-B:201–8.