2014

Catch before a fall: Demonstrating an opportunity for improving outpatient efficiency

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The *Catch Before a Fall* project has been funded with a grant from the National Osteoporosis Society.

ABSTRACT

Introduction

Outpatient clinics offer an opportunity for collating valuable health information from a captive patient population. We have previously developed a modified fracture risk assessment (FRAX) tool, enabling patients to self-assess their osteoporotic fracture risk in a touch-screen computer format which was found to be acceptable to the patient. We aim to validate the accuracy of our tool against the traditional questionnaire.

Materials and Methods

50 patients over 50 years of age within the fracture clinic completed our modified FRAX questionnaire. Responses were compared against the traditional healthcare professional (HCP)-led questionnaire. Correlation was assessed by Cohen's Kappa statistic, Fishers exact test and Chi-squared tests for each potential FRAX outcome of “Treat”, “Measure BMD” and “Lifestyle advice”.

Results

The FRAX tool was completed by 88% of patients, the remaining 6 lacked a confidence in estimating either their height or weight (Age range 51-98yrs). Our tool achieved >95% sensitivity and specificity for the "Treat" and “life style” advice groups with a Cohen's Kappa "very good" agreement for all groups.

Discussion and Conclusion

Our modified tool provides a simple, accurate and reliable method for patients to self-report their own FRAX score outside the clinical contact period, thus releasing the HCP from the time required to complete the questionnaire and potentially increasing our capture rate of at-risk patients. Modifying the previous fracture question to include current fracture and provide height and weight assessment facilities within clinic improves self-reported accuracy.

Word count (excluding subheadings): 227/250

MeSH Headings: osteoporosis; osteoporotic fractures; World Health Organisation; outpatients; ambulatory care; efficiency, self-assessment

MAIN ARTICLE

Introduction

Across all hospital specialties, a significant amount of a doctor's working week is dedicated to outpatient clinics. Yet despite the importance of this service in overall patient care, it is traditionally viewed as an area of inefficiency, where patients can expect to wait significantly longer than their 10-minute allocated appointment in order to be seen, and then longer still for any necessary investigations and management. A contributing factor is the time spent by doctors addressing administrative tasks, rather than consulting patients.(1) It is a common cause of patient frustration.(2)

Waiting time could be used to gain valuable information on a patient's state of health or determine outcome measures on a condition through Patient Reported Outcome Measurement tools. Furthermore, this time could even be used to identify new conditions that may require additional treatment.

One particular condition that is often overlooked within a fracture clinic, or can take time assessing, is a patient's risk of developing a future fracture as a result of osteoporosis.

The World Health Organisation (WHO) Fracture Risk Assessment Tool (FRAX) is a validated questionnaire based on individual patient models that integrates clinical risk factors to produce a 10 year probability of hip fracture (HF) and major osteoporotic fracture (MOF).(3) This is traditionally a questionnaire that would be completed by a Heath Care Professional (HCP) with the patient present, and the answers transferred to a computer programme to perform risk calculation. This is, however, a time-consuming process. New formats have been developed by the International Osteoporosis Foundation (IOF), such as the FRAX Pad

(available at www.iofbonehealth.org) which enables the capture of risk factor variables prior to consultation, but this still requires input onto computer software. Furthermore, no studies have been carried out assessing the reliability or validity of patient-reported data using such a tool for self-assessment.

In order to address this issue, we have previously developed a modified FRAX tool formatted for touch screen computers which enables patient self-reporting, and already demonstrated their ability to use such a system effectively, including the elderly population.(4,5) In part, this is due to a change in culture within General Practice centres where patients now regularly use touch screens to "check-in" prior to their consultation. In the present study we aim to validate the tool against the gold-standard HCP-led questionnaire. Successful validation will enable us to incorporate it into our touch-screen clinic registration system, so that patients may ascertain their own FRAX score prior to their consultation, thus improving overall efficiency.

We highlight the opportunity for gaining clinically relevant patient data in an effective and efficient manner, which utilises valuable time currently lost in many outpatient clinics.

Materials and Methods

Following registration with Barnet R&D department, 50 patients over 50 years of age within the fracture clinic were randomly selected in order of arrival and consented to involvement in the study. They each independently completed a paper equivalent of our modified FRAX questionnaire (see figure 1). Answers were collated by a HCP (specialist nurse or doctor) and used to produce a FRAX score, as would be carried out automatically on our touch-screen

computer system. Scores were then compared with those achieved by the traditional HCP-led questionnaire which was also completed during the clinic.

[Figure 1 should be positioned here, or as an appendix at the end of the paper]

Data was collated using Microsoft Excel software. The FRAX tool provides one of three outcomes: “Lifestyle advice only” for low risk patients, “Measure bone mineral density (BMD)” for those of moderate risk, and “Treat” for those of high risk. For each outcome the sensitivity, specificity, positive predictive value and negative predictive value of our modified FRAX tool was assessed, as compared to the gold-standard HCP-led questionnaire. Cohen’s kappa statistics were then used to measure the degree of agreement between the two tools for each outcome, whereby agreement due to chance is factored out.(6) The strength of agreement is defined as “poor”, “fair”, “moderate”, “good” or “very good” according to the Kappa value. Calculations were carried out using GraphPad Online QuickCalcs software.(7) Fishers exact test was also used to assess degree of interaction between doctor and patient decisions, and was calculated, along with a variety of Chi-squared tests, by our statistician.

Patient responses were also used to identify questions in our modified FRAX tool that require adjustment to avoid misinterpretation and improve validity of responses.

Results

The study population included 50 patients over the age of 50 years, with an age range of 51 – 98 years. 70% of patients were female. 88% of patients were able to answer sufficient

questions to successfully complete the FRAX tool themselves. 6 were unable to do so due to a lack of confidence in estimating either their height or weight. This was then measured by staff to fill in these two questions .

The average difference between a patient's reported and actual height was 2.2cm, and the weight 1.9kg. In our fracture clinics, height measures and scales are readily available and used regularly, therefore in the event of a patient being unable to provide an estimate immediately, accurate readings are easily achievable for all.

Surprisingly, the question pertaining to previous fractures achieved the lowest correct response rate of 76%. This was because of a misinterpretation of the term "previous fracture", with patients not recognising that this should include any current fracture for which they might be attending the clinic. Patients agreed that this issue could be easily overcome by adjusting the question to state this.

Of the remaining questions, a correct response rate exceeding 85% was achieved in each.

Sensitivity, specificity, positive predictive value and negative predictive value of our modified FRAX tool were ascertained for each possible outcome, as compared to the gold standard HCP-led questionnaire (*see figure 2*). Scores were first calculated from patient responses without any correction for height and weight error, or misunderstanding of the term "previous fracture".

Initial scores were less satisfactory than we had predicted, ranging from 42% for sensitivity of "measure BMD" to 93% for negative predictive value of "lifestyle advice only". However, when accounting for correction of the patients understanding of the term "previous fracture" and also height and weight measurements for uncertain patients, scores improved

significantly. As shown in *figure 2*, each outcome achieved two of the four statistical measures at 100%, and the majority of scores throughout were >90%. The only measure to be below 80% was sensitivity of "measure BMD", at 79%. This means that of those patients whose modified FRAX tool gave a response of "measure BMD", 79% would also have achieved the same result with the traditional HCP-led questionnaire. Of the remaining 21% (4 people), 3 people were advised treatment, and 1 lifestyle advice. However, we can see that the sensitivity of our test for detecting those that require treatment is 100%, therefore we would statistically never undertreat a patient, but rather treat where there is discordance between the results.

[Figure 2 should be positioned here]

Cohen's Kappa was then used to assess the degree of agreement between our modified FRAX tool and the HCP-led questionnaire with data corrected for height, weight and misinterpretation of "previous fracture" (*see table 1*). Our modified tool has achieved the highest level of agreement with the traditional tool, with a kappa value in the "very good" strength of agreement category for each potential outcome.

[Table 1 should be positioned here]

Fishers Exact test was computed and there was a significant interaction between doctor and patient decisions (X^2=72.29, df 4, 1, p<.001). The analysis revealed that patients and doctors

significantly agreed outcome for 'Treat' (p<.001), 'BMD' (p<.001) and 'Lifestyle' (p<.001) with standardised residuals of 6.2, 5.9 and 6.8 respectively (Table 2). Both 'Treat' and 'Lifestyle' had a 100% consensus, with 'BMD' highlighting a 78.9 compliance. All other outcomes were revealed to be significantly under represented.

Discussion

Osteoporosis is a progressive disease affecting bone mass and structure, resulting in an increased risk of fracture, particularly of the spine, hip and wrist. In order to help the early detection and prevention of osteoporosis and fractures, the World Health Organisation (WHO) have recently developed the Fracture Risk Assessment Tool (FRAX) to estimate the 10-year probability of hip fracture (HF) and major osteoporotic fracture (MOF).(3) The tool is based on 11 risk factors, plus hip bone mineral density (BMD) where available. An online tool is available (http://www.shef.ac.uk/FRAX/tool.jsp), and is traditionally completed by the HCP to ensure accurate and appropriate responses.

In our own fracture clinic, we complete the FRAX tool for all patients over the age of 50 years during their clinic appointment to identify at-risk patients. It is recognised that this is occupying a significant proportion of a doctor's time, and possibly contributing to delays and increased waiting times for patients. This appears to be a commonly encountered problem across the specialities, with a study in 2002 identifying that 41% of a consultant's time in a general surgery clinic was spent away from the patient, the majority being assigned to administrative tasks.(2)

As one of the most populated outpatient specialties, time efficiency is considered paramount in orthopaedic clinics.(8) It is also widely recognised that a well-run clinic may not only improve the patient experience but also disease control and overall patient care, meaning that it should be at the forefront of every Trusts practice to improve this service.(9)

In 2013 we set about seeking methods of reducing and utilising clinic waiting times more effectively by optimising completion of the FRAX tool, whilst improving the identification of at-risk patients with a low cost screening strategy.

With this in mind, the *Catch Before a Fall* (CBaF) project was set up, with the aim of developing a mobile, touch-screen tool to collect and calculate FRAX data. Touch screen technology is becoming more evident in the outpatient clinic setting, facilitating data collection, saving time on administration, scoring and data entry, and increasing utility by allowing immediate access to results. Our modified FRAX tool has been developed as a touch-screen application to take advantage of this, and has been shown to be an acceptable and efficient method of data collection through trials on inpatients and outpatients at the Royal National Orthopaedic Hospital, Stanmore and two GP surgeries, with patients positively reporting its ease of use, and 75% preferring it to a paper or telephone questionnaire.(4,5) The aim of this study was to validate our modified FRAX questionnaire against the current gold-standard HCP-led FRAX questionnaire.

In reviewing patients' answers, it was evident that certain questions were either difficult to answer or misunderstood. Some patients, for example, were unable to give an estimate of their height or weight, which are both required by the FRAX tool in order to produce a risk analysis. However, those that did provide an estimate did so with a reasonable degree of accuracy, answering to within an average of 2.2cm of their height, or 1.9kg of their weight.

Where there is a discrepancy, it is noticeable that patients tend to underestimate their weight, but overestimate their height, which has the potential to significantly affect body mass index (BMI) calculation. In most outpatient clinic settings, including our own fracture clinic, height measures and scales are readily available. It therefore seems reasonable that this problem could be easily overcome by measuring these parameters for patients who are uncertain, or indeed all patients that enter the clinic.

The question “have you broken a bone in the last 20 years?” proved surprisingly misleading, with many patients not recognising that they should include current fractures in their answer, but instead assuming that it was asking if they had any fractures prior to any current. Also of note was that due to the large number of elderly patients in the local population, a small number had sustained fractures greater than 20 years ago and therefore did not include them in their response. It may be appropriate therefore, to consider extending this to a longer period of time, or removing the time limit altogether. Patient’s agreed that with some additional clarity in the question, correct responses would be easily achieved.

After these changes are accounted for, we have shown that our modified FRAX tool has a “very good” strength of agreement with the validated WHO FRAX tool, using Cohen’s kappa analysis, and significant interaction between the doctor and patient responses using Fishers exact test. We have also identified a high level of sensitivity, specificity, positive predictive value and negative predictive value in each outcome to corroborate with this, demonstrating that our touch-screen modified FRAX tool questionnaire can produce comparable results to the traditional HCP-led version.

This approach has already been utilised in other areas of medicine, with touch-screen adaptations of established questionnaires demonstrating good equivalence and reliability.

Examples include the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire–Core 30, version 2.0 (EORTC-QLQ-C30),(10–12) and an electronic version of the Medical Outcomes Studies Short Form questionnaire (SF-36) in rheumatology.(13)

This study showed that further modification to the questions is required for fracture clinic use compared to General Practice waiting room clinics previously tested. Using the waiting room both in Hospitals and within GP surgeries as an opportunistic time to collect additional information for other musculoskeletal conditions could also be considered.

Conclusion

The *Catch Before a Fall* project has developed a touch-screen modified FRAX tool that has been demonstrated to be both acceptable to patients, and comparable to the HCP-led questionnaire traditionally used. The next step will be to incorporate the software into our current touch-screen registration system, and potentially future deployment on a larger scale.

We hope this work acts as a demonstration of the broad potential for touch-screen based applications as a means of facilitating data collection, with the additional advantages of saving time on administration, scoring and data entry, and increasing utility by allowing immediate access to results. We encourage others to consider ways in which they may be able to improve their own outpatient services through similar strategies.

Word count (exclusive of abstract, reference list, tables and legends): 2251

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		Kappa	*SE of kappa*	*95% CI*	*Strength of agreement*
Lifestyle advice only	*Uncorrected*	0.582	0.114	0.358 to 0.806	Moderate
	Corrected	0.995	0.045	0.867 to 1.000	***Very good***
Measure BMD	*Uncorrected*	0.353	0.132	0.094 to 0.612	Fair
	Corrected	0.823	0.084	0.659 to 0.987	***Very good***
Treat	*Uncorrected*	0.485	0.138	0.214 to 0.755	Moderate
	Corrected	0.865	0.075	0.718 to 1.000	***Very good***

Table 1: Cohen's kappa statistical analysis to assess strength of agreement between our modified FRAX tool and the HCP-led questionnaire, for both uncorrected data, and data corrected for patient height and weight, and misinterpretation of the term "previous fracture" [SE = standard error; CI = confidence intervals]

Table 2: Decision between Doctor and Patient by outcomes

	Total (N)	**%**	**Residual**	**P value**
Treat				
Doctor Treat Vs Patient Treat	15	100	6.2	***
Doctor Treat Vs Patient BMD	0	0	-3.0	***
Doctor Treat Vs Patient Lifestyle	0	0	-3.3	***
Total	15	100%		
BMD				
Doctor BMD Vs Patient BMD	15	78.9	5.9	***
Doctor BMD Vs Patient Treat	3	15.8	-2.3	*
Doctor BMD Vs Patient Lifestyle	1	5.3	-3.4	***
Total	19	100%		
Lifestyle				
Doctor Lifestyle Vs Patient Lifestyle	16	100	6.8	***
Doctor Lifestyle Vs Patient Treat	0	0	-3.6	***
Doctor Lifestyle Vs Patient BMD	0	0	-3.2	***
Total	16	100%		

*** p<.001, ** p<.01 *p<.05 NS Not Significant