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Article

2006

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How to cite

BIDEAU SAR, Martine et al. Benefits of a programme taking advantage of patient-instructors to teach and assess musculoskeletal skills in medical students. In: Annals of the rheumatic diseases, 2006, vol. 65, n° 12, p. 1626–1630. doi: 10.1136/ard.2004.031153

This publication URL: <https://archive-ouverte.unige.ch/unige:26029>

Publication DOI: [10.1136/ard.2004.031153](https://doi.org/10.1136/ard.2004.031153)

EXTENDED REPORT

Benefits of a programme taking advantage of patient-instructors to teach and assess musculoskeletal skills in medical students

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*Ann Rheum Dis* 2006;**65**:1626–1630. doi: 10.1136/ard.2004.031153

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Accepted 4 May 2006
Published Online First
17 May 2006

Aim: To evaluate a rheumatoid arthritis patient-instructor-based formation–assessment programme for its ability to improve and assess musculoskeletal knowledge and skills in third-year medical students.

Methods: (1) The quality of our musculoskeletal teaching was assessed before patient-instructor intervention through an open-questions test (pre-test) and performance record forms (PRFs) filled in by the patient-instructors. (2) The improvement afforded by patient-instructors was evaluated through a second (identical) open-questions test (post-test). (3) The resulting skills in the students were further assessed by an individual patient-instructors physical status record form (PSRF), filled in by the students.

Results: Pre-tests and post-tests showed an improvement in correct answers from a mean score of 39% to 47%. The history-taking questions that obtained <50% scores in the pre-test mostly dealt with the consequences of a chronic illness. Intervention of patient-instructors especially improved knowledge of the psychosocial aspects and side effects of drugs. With regard to physical examination, patient-instructors markedly improved the identification of assessment of signs of active and chronic inflammation. PRF analysis showed that 10 of 28 questions answered by <50% of the students were related to disease characteristics of rheumatoid arthritis, extra-articular signs, side effects of drugs and psychosocial aspects. Analysis of the PSRF indicated that the weakness of our students' physical examination abilities in particular is related to recognising the types of swelling and differentiating tenderness from pain on motion.

Conclusion: This study proves the considerable benefits of the involvement of patient-instructors in the teaching and assessment of clinical skills in students.

High-quality teaching in musculoskeletal medicine is particularly important, given the high incidence of related disorders.¹ Studies on US residents, however, showed low scores in musculoskeletal evaluation,² and our recent analysis showed a similar tendency in Geneva, Switzerland.

Passive teaching does not seem to be optimal.^{2–3} More active training can be provided efficiently by healthy, trained, standardised patients,^{4–8} unable, however, to enact most physical changes, or by real patients, patient-instructors, educators or partners. Patient-instructors are trained to teach elements of history taking and examination.⁹ They may be at least equal to consultant rheumatologists or internal medicine residents in teaching musculoskeletal examination and communication skills.^{10–14}

In 2001, we developed a student-centred programme,¹⁵ in which part of the teaching was provided by patient-instructors. These patient-instructors were trained to assess students' skills, correct and teach them, and deliver direct feedback, which was shown to stimulate further learning.¹⁶

This study was designed to evaluate this patient-instructor-based assessment–formation programme. The quality of patient-instructor assessment on a student's musculoskeletal skills before patient-instructor intervention was evaluated by comparing an open-questions test (pre-test) with a performance record form (PRF) filled out by the patient-instructors. The improvement afforded by patient-instructors was evaluated through a second (identical) open-questions test (post-test) and by comparing students' findings, obtained by an individual patient-instructor physical status record form (PSRF), filled in at the end of the session, with a rheumatologist record of the same PSRF.

MATERIALS AND METHODS

The Geneva Medical School Programme

In our 6-year curriculum, pre-clinical basis of the musculoskeletal system is taught at the beginning of the third year, in a 4-week unit. It includes four 2-h seminars on history taking and clinical examination, delivered to 6–8-student groups by senior rheumatologists, orthopaedic surgeons or physiatrists. At this point, the students have almost no clinical experience. They receive a 62-page booklet (156 drawings) on musculoskeletal history taking and examination, with all important steps and tests, designed by rheumatologists and orthopaedic surgeons from the universities of Zurich and Geneva, given as obligatory reading. Further exercise and training is offered during four additional voluntary sessions, attended by about 80% of the students.

Patient-instructor-based education and assessment

Patients who have rheumatoid arthritis took part in the patient-instructor-based programme. Its principal aims are to teach important aspects of history taking in the context of a chronic inflammatory disease, and familiarise the students with the examination of affected joints. Special emphasis is laid on psychoemotional and physical consequences of chronic diseases, and the students are given a unique opportunity to obtain direct constructive and didactic feedback from the patient-instructors on the overall approach to the patient (empathy, politeness, appropriate information and listening).

Abbreviations: PRF, performance record form; PSRF, physical status record form

Selection and formation of patient-instructors

In collaboration with the Swiss League Against Rheumatism, the Geneva Rheumatoid Arthritis self-help group and Pharmacia-Pfizer (which sponsors the formation of educators in rheumatology), we selected 11 volunteer patients with rheumatoid arthritis. They were all women, aged 29–66 years and have had rheumatoid arthritis for at least 5 years. Selection criteria included diagnosis of rheumatoid arthritis (American College of Rheumatology criteria), well-demonstrable features of rheumatoid arthritis, ability to endure repeated musculoskeletal examination, and good communication skills and intellectual levels. Patient-instructors had to learn the essentials of medical language, musculoskeletal anatomy, common physical findings in rheumatoid arthritis and the important examination tests. They needed to have symptoms and signs of active joint inflammation, including one swollen joint, but could differ as to the number of abnormal findings.

The organising team (rheumatologists, orthopaedic surgeons and teachers of the clinical skills programme) trained the patient-instructors on history taking and physical examination of the knee and hand for a minimum of 30 h. We focused on knees and hands to limit the amount of patient learning and optimise their proficiency. Patient-instructors received anatomy diagrams, the booklet received by the students and an article about giving feedback. They learnt to use the PRF to optimally record students' performances and give feedback. The PRF included items on history taking, physical examination and the student's overall approach to the patient. The patient-instructors were instructed to record the history-taking items (according to their own history) and to discuss every element missed or inadequately examined. They were trained to correct the students on physical examination by demonstrating or completing missed or incorrectly executed tests, and, finally, give them feedback on their overall approach. We organised several training sessions and continually assessed the competence of the patient-instructors. Additional teaching and training was provided whenever necessary. Slight differences between the patient-instructors with regards to students' assessment were inevitable, but were minimised by using the detailed PRF and strict directions on its use.

Structure of the patient-instructor-based assessment training

All third-year medical students ($n=61$) participated individually in a 60-min patient-instructor-based assessment training, at the same time during their instruction (end of the four 2-h musculoskeletal seminars). Sessions proceeded like normal consultations, with students playing the doctor's part. During the first 20 min they had to take history and then received a 10-min feedback from the patient-instructors. Next, students had 30 min to examine one hand and one knee, during which patient-instructors continually corrected and taught the students. The patient-instructors were instructed to stick closely to the PRF and ways to examine or execute tests as taught to the students and described in the booklet. At the end of the 60 min, patient-instructors gave feedback to the students about their general performance and attitude: such feedback is most effective when given immediately.¹⁶

Evaluation study of the training assessment programme

Pre-test and post-test

Immediately before their session, the students answered seven open questions (pre-test; box 1). After the session, they completed another identical form (post-test). Both the tests were developed by consensus but not independently validated. They were not seen by the patient-instructors to

Box 1: Pre- test and post-test questions

History taking

- A. Which important questions about drugs have to be asked?
 - (a) Which medications have been taken;
 - (b) for how long;
 - (c) what doses;
 - (d) what effects they had;
 - (e) what side effects they had
- B. Which domains have to be explored for evaluating the consequences of a chronic disease?
 - (a) Physical;
 - (b) psychological;
 - (c) emotional;
 - (d) social;
 - (e) financial;
 - (f) professional;
 - (g) family
- C. Which elements of the history taking allow to distinguish inflammatory from mechanical pain? Inflammatory pain:
 - (a) Morning or rest preponderance;
 - (b) association with morning stiffness; mechanical pain;
 - (c) evening preponderance or
 - (d) elicited by use

Physical examination

- A. Which physical signs characterise active joint inflammation?
 - (a) Redness;
 - (b) swelling;
 - (c) warmth;
 - (d) tenderness;
 - (e) pain on motion;
 - (f) effusion;
 - (g) limitation of active and passive range of motion
- B. What are the possible consequences of a prior joint inflammation (not active anymore)?
 - (a) Deformity;
 - (b) axis deviation;
 - (c) subluxation–dislocation;
 - (d) decreased range of motion;
 - (e) ankylosis;
 - (f) pain on motion;
 - (g) instability
- C. How may a knee effusion be detected?
 - (a) Bulge sign;
 - (b) patellar tap test
- D. What is the best method of examining each metacarpophalangeal joint individually?
 - (a) By alternate bimanual palpation–compression (the thumb and index finger of one hand palpate–compress the lateral aspect of the metacarpophalangeal joint alternatively with the thumb and index finger of the other hand palpating–compressing the medial aspect)

prevent influencing the information provided to the students. Standardised answers expected to be given were predefined (38 in all; box 1).

Evaluation of the students by the patient-instructors

The PRFs used to record students' skills were composed of three parts: history taking (28 items), physical examination of the hand and the knee (40 items) and general approach to the patient (8 items). Each item had the same weight for scoring.

Individual patient-instructor PSRF

For each patient-instructor, a PSRF on the clinically dominant knee (most characteristic changes of rheumatoid arthritis) and hand (all joints) was recorded. It detailed all abnormalities (skin, joint, tendon and bursa). For each patient-instructor, a rheumatologist recorded the PSRF immediately before the beginning of the sessions. Directly after the sessions, students filled in the same PSRF. The students' findings were compared with those of the rheumatologists. There was a 1–4-week delay between examination by the student and the reference examination. The patient-instructors were to report any differences occurring during this delay to minimise possible effect on scoring.

Debriefings and global feedback

A global cross-feedback (teaching team to the students, and students to the teaching team) was implemented at the end of the sessions, and a satisfaction questionnaire given to the students. A similar cross-feedback between the teaching team and the patient-instructors took place a few days later.

Statistical analysis

Paired Student's *t* test was used to assess differences between means in the pre-test and post-test, and the McNemar test was used to assess differences between nominal values; $p < 0.05$ was considered significant.

RESULTS

Selection and training of patient-instructors

All patients achieved their training and were considered able to perform well. One patient, however, could not participate actively because of severe exacerbation of her disease.

Pre-test and post-test performances

The mean (standard deviation) total scores for the 38 expected answers were 39% correct in the pre-test and 47% in the post-test (14.7 (4.0) *v* 17.8 (3.9), $p < 0.001$).

History taking

In the pre-test, the mean score for the 16 items (table 1) was 46%; of these, eight obtained $< 50\%$ scores: all except two dealt with psychosocial and physical consequences of chronic illness; the other two were regarding the characteristics of inflammatory versus mechanical pain. In the post-test, the score increased 46%–56% (7.3 (2.8) *v* 9.0 (2.4) correct answers, $p < 0.001$). Comparison of the pre-test and post-test scores showed that intervention by the patient-instructor had especially improved the psychosocial aspects: psychological ($p < 0.001$), emotional ($p < 0.008$), social ($p < 0.001$), professional ($p < 0.002$) and family ($p < 0.001$). Students also learnt significantly about the side effects of drugs ($p < 0.001$).

Physical examination

The global score for the 22 items was 34% correct answers (table 1). In the post-test, it increased from 34% to 40% (7.4 (2.1) *v* 8.8 (2.3) correct answers, $p < 0.001$). Two additional answers were given by $> 50\%$ of the students: tenderness as a sign of active inflammation and deformities as characteristic consequences of chronic inflammation. Students significantly

Table 1 Correct answers in pre-tests and post-tests regarding history taking and physical examination

Questions	Answers	Pre-test (%)	Post-test (%)	p Value (McNemar test)
History-taking				
1Aa	Which drug	90	93	NS
1Ab	How long	67	72	NS
1Ac	What doses	64	64	NS
1Ad	Effects of drugs	66	69	NS
1Ae	Side effects of drugs	54	82	< 0.001
2Aa	Physical consequences	34	41	NS
2Ab	Psychological consequences	57	80	< 0.001
2Ac	Emotional consequences	18	31	0.008
2Ad	Social consequences	49	72	0.001
2Ae	Financial consequences	7	13	NS
2Af	Professional consequences	39	56	0.002
2Ag	Family consequences	20	51	< 0.001
3Aa	Morning or rest preponderance	53	53	NS
3Ab	Morning stiffness	43	48	NS
3Ac	Elicited by use or evening preponderance	54	56	NS
Physical examination				
1Aa	Redness	93	97	NS
1Ab	Swelling	43	53	0.031
1Ac	Warmth	93	95	NS
1Ad	Tenderness	25	25	NS
1Ae	Pain on motion	15	18	NS
1Af	Effusion	34	43	NS
1Ag	Limitation of range of motion	54	56	NS
2Aa	Deformity	36	51	0.004
2Ab	Axis deviation	2	3	NS
2Ac	Subluxation–dislocation	0	0	NS
2Ad	Ankylosis	8	13	NS
2Ae	Pain on motion	15	16	NS
2Af	Instability	3	3	NS
3Aa	Bulge sign	67	89	< 0.001
3Ab	Patellar tap test	54	80	< 0.001
4Aa	Bimanual palpation with four fingers	15	36	< 0.001

Questions and answers as given in box 1.

NS, not significant.

learnt about the correct technique for examining metacarpophalangeal joints ($p < 0.001$), how to perform the metacarpal squeeze ($p < 0.016$) and to correctly execute the patellar tap ($p < 0.001$) and bulge tests ($p < 0.001$).

Student assessment by the PRF

The mean total score for history taking was 67% correct items. Of 28 expected questions, 10 were actually asked by $< 50\%$ of the students: nature of joints' involvement (32%), extra-articular signs of rheumatoid arthritis (22%) and side effects of the drugs (48%). Other important questions under the 50% score dealt with the psychosocial aspects of the illness. Some items were similar in the PRF and in the pre-test: regarding drugs, psychosocial aspects of a chronic illness and pain characteristics of inflammatory diseases. Some of these questions were correctly considered by students before seeing the patient-instructors (pre-test) but not asked during the history taking (side effects of drugs, psychological and social effects of a chronic disease; table 2). Conversely, students asked an adequate number of questions while interacting with the patient-instructors but did not mention them in the pre-test and post-test forms (effects of drugs, emotional, family and professional aspects, and joint pain). With regard to the physical examination, the mean total score reached 85% correct answers for the hand and 86% for the knee.

Physical status record form

Of 12 items for each joint, the mean score reached 74% for the hand and 83% for the knee (table 3), which was similar to the

Table 2 Comparison of the pre-test and performance record form

Questions	Students who mentioned the question in the pre-test (%)	Students who asked the question of the patient instructor (%)
Which drugs did you take at the beginning of your illness?	90	84
Which drugs are you taking now?	90	93
Effects of drugs at the beginning of treatment	66	85
Effects of drugs at present	66	92
Psychological consequences of your illness	57	28
Secondary effects of the treatment	54	48
Social consequences	49	20
Morning tenderness	43	69
Professional consequences	39	80
Physical consequences	34	44
Family reactions to the diagnosis	20	48
Actual family consequences	20	46
Emotional consequences	18	70
Stiffness	18	36

physical examination part or the PRF. The weakest part of the physical examination related to recognising the presence or absence of swelling, and differentiating soft-tissue swelling from bone deformation (56% for hand and 64% for knee).

Appraisal of students and patient-instructors

The students virtually unanimously judged this experience to be extremely beneficial: they reported that their capacity to understand patients' suffering from a chronic disease was improved, thanks to the direct feedback; they reported an improvement in the understanding of history taking from patients with a long chronic illness. Regarding the physical examination, they acknowledged important improvement owing to the status and technical expertise of the patient-instructors, and to the immediate feedback. They especially appreciated the possibility of immediately clarifying uncertainties. They considered the patient-instructors well prepared, and said that they had gained much self-confidence and expertise in dealing with a patient having a chronic disease, and learnt a lot about the lives of patients who have rheumatoid arthritis. They also appreciated the human relationship with the patients.

The patient-instructors also expressed considerable satisfaction. Most of them had dealt with doctors who did not meet their expectations, with regard to physical examination, medical (diagnostic) capabilities and, particularly, psychosocial comprehension and support. They believed that this programme would certainly markedly improve performances of future doctors. For some, it even meant that they had

finally put behind them the anger and disappointment of earlier misdiagnoses and lack of comprehension. They liked the contact with the students and did not suffer, physically or emotionally, from these sessions. We kept the number of 1-h sessions to ≤ 2 per day, and ≤ 4 per week, which was expressed to be reasonable but the upper limit.

DISCUSSION

This study first showed the benefits of patient-instructor intervention through the use of pre-tests and post-tests. The marked improvement in grasping the psychological, emotional, social, professional and family aspects of the disease may largely be due to the direct contact with real patients, and being able to vividly report their illness and feelings. It suggests that the intervention of patient-instructors really adds another dimension to traditional teaching.

Despite these improvements, the mean score of the post-test was rather low (47%). At least two explanations could account for this observation: (1) the assessment method (pre-test *v* post-test) was not optimal; and (2) teaching was not effective. Ineffectual teaching alone probably did not account for this low score, given the good results of the PRF and PSRF. On the other hand, the fact that the pre-test versus post-test was not sanctioning, implying that students were less concerned,¹⁷ certainly contributed. Also, expected answers to some questions might have been too restricted and subjective. Still, the pre-test versus post-test certainly represents a good assessment tool.¹⁸ Open questions are difficult to score,¹⁷ but have considerable advantages: they indicate what students are able to express spontaneously and enable formulation of questions unsuitable for "multiple choice" or "true-false" formats, in which answers would be suggested.

The mean score of the PRF proved to be good. In this study, we did not attempt to assess the performance of the students who attended the additional voluntary sessions compared with those who did not. With regard to history taking, the most difficult items for our students were related to the psychosocial aspects of a chronic illness. This result is consistent with those of the pre-test versus post-tests. It suggests a real gap in the perception of this aspect by the students. This may be because, confronted for the first time with a real patient, they were emotionally concentrated on the pathology. Additionally, the time may have been insufficient to consider these questions adequately. McClure identified the same problem in general practitioners.¹⁹ It seems to be present in Switzerland too, as most of our patient-instructors stated that the doctors they dealt with did not show enough interest in these questions. This suggests that education on psychosocial aspects of chronic diseases might, overall, often be insufficient. The performances on these aspects markedly improved in the post-test, which

Table 3 Results of the physical status record form

Items	Knee (%)	Hand (%)
Inspection		
Redness	100	80
Scars	88	92
Axis deviations	82	84
Skin abnormalities	72	72
Swellings	64	56
Palpation		
Warmth	100	77
Pain on motion	92	51
Effusions	79	63
Tenderness	60	61
Additional testing		
Instabilities	95	85
Tenosynovitis	84	80
Limitations of joint range of motion	82	85

The percentage of items refers to those correctly filled in by the students in the physical status record form.

might represent one of the greatest achievements of our patient-instructor-based programme. An additional aspect that proved difficult for our students was investigating the eventual presence of extra-articular involvement. Third-year, pre-clinical-level students were certainly not well prepared for these specific features, but also learnt much from the patient-instructor-based programme.

A comparison of the history-taking parts of pre-test versus post-tests and PRF showed that some aspects were considered well by the students when physically present with the patients (PRF), but not before and after the session (pre-test or post-test). These aspects mainly concerned effects of drugs, emotional, family and professional consequences, and the characteristics of joint pains. This finding suggests that the relationship established between the student and the patient-instructor played an important part in bringing these questions to their minds. The assessment by the patient-instructors shows that students are better than suggested by the pre-tests and post-tests. This further proves the importance of the PRF evaluation.

Despite efforts regarding selection and training, slight differences between the patient-instructors were inevitable, and certainly resulted in some degree of heterogeneity as to the benefits of the programme at the individual student level. The good results of the PSRF, however, underline the overall benefits of the feedbacks by the patient-instructors, suggesting that the patient-instructors were efficient in correcting and teaching the students during the physical examination. It confirms that this kind of teaching has a valuable effect on learning in students, as is also documented by other studies.^{9–20} Students often had difficulties in detecting synovial effusions, tenderness and pain elicited by mobilisation. This may partly be explained by the fact that these students encountered authentic patients, with real and sometimes severe pathologies, for the first time. They were probably hampered by the fear of provoking pain or damage during the examination.

In this study, patient-instructors thus acted as teachers as well as evaluators. The different tools of assessment used in this study seem to be complementary and give interesting and considerable information: they disclose gaps in our teaching and prove the value and benefits of patient-instructor-based teaching in pre-clinical-level students. However, the persistence of these benefits was not tested neither nor was a comparison of this teaching with traditional teaching or teaching by standardised patients carried out. A part of this teaching assessment could have probably been achieved with standardised patients, possibly with better homogeneity. We think, however, that patient-instructors offer the distinguished advantage of being able to present actual joint changes in rheumatoid arthritis and give better feedback regarding the overall approach to the patient and the importance of some aspects of history taking, such as the psychosocial implications of the disease.

We did not compare assessment by patient-instructors to that by rheumatologists. The assessment by rheumatologists might be technically more accurate, but we believe that patient-instructors might be more subtle and sensitive regarding the general approach to the patient; this issue will be the subject of another study.

Finally, this programme certainly spared a considerable amount of faculty time: once trained, a group of 8–10 patient-instructors, with minimal rehearsal, can individually teach and test >100 students yearly for several years.

In conclusion, we believe that this study further documents the considerable benefits of the involvement of patient-instructors in the teaching and assessment of clinical skills in students, as reported previously.^{5 10 11 18 21 22} The originality of this patient-instructor-based programme and study is to show that valuable teaching and assessment can be achieved in one single intervention by a patient-instructor. The exceptional

enthusiasm manifested by the students further substantiates the value of such patient-instructor-based programmes.

ACKNOWLEDGEMENTS

We are grateful for the efficient help and contribution of the following patient-instructors: D Arbel, AM Bauer, L Beni, A Berger, I Berlie, G Bossy, G Egger, M Esposito, P Magnin, M Patrizzi and F Sulser. We particularly thank A Berger for expert English proof-reading. We also thank Gisela Dalvit, General Secretary, Swiss League Against Rheumatism.

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Funding: The patient-instructor-based formation–assessment programme was supported in part by Pharmacia (Dübendorf, Switzerland), Pfizer (Zurich, Switzerland) and the Swiss League Against Rheumatism (Zurich, Switzerland).

Competing interests: None declared.

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Ann Rheum Dis 2006 65: 1626-1630 originally published online May 17, 2006

doi: 10.1136/ard.2004.031153

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