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ORIGINAL ARTICLE

Costs of Workups for the Diagnosis of Early Arthritis: Results of a Nationwide Survey

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Objective. **To evaluate the costs of workups to diagnose early arthritis.**
Methods. **In 2000, the French Society for Rheumatology conducted a survey of a representative sample of French and Belgian rheumatologists (n = 239). The respondents were asked to consider 2 hypothetical scenarios, 1 describing undifferentiated arthritis and the other more suggestive of rheumatoid arthritis. They were then asked what diagnostic workup they would order. Costs for each study were determined in 2001 euros, according to the French public health system fee schedules.**
Results. **In total, 151 rheumatologists participated in the study (63%). The mean diagnostic costs were 406.5 ± 194.3 € for the case with no diagnostic clues, and 280.7 ± 154.3 € for the case suggestive of early RA. Responses were very heterogeneous. The 2 main sources of expenditure were immunology tests and imaging. Hospital staff physicians tended to order more expensive workups, and costs tended to vary inversely with physician experience. The most important predictor of cost was diagnostic doubt, as estimated by the number of diagnoses proposed by respondents in each case; each additional diagnosis cost an additional 26.1–35.8 €.**
Conclusion. **Diagnostic workups after a first medical visit for early polyarthritis result in substantial direct costs. This observation and the great variability observed in physicians' practices point out the need for consensus on the appropriate workups for these patients.**

KEY WORDS. Rheumatoid arthritis; Early arthritis; Costs; Diagnosis.

INTRODUCTION

Since the demonstration that rapid initiation of disease-modifying antirheumatic drugs (DMARDs) improves rheumatoid arthritis (RA) outcome (1-3), much effort has been devoted to its early diagnosis. Started within 3–6 months of onset, DMARDs are associated with a significantly higher probability of remission or low disease activity (3–5). Recent-onset polyarthritis, however, may have several causes other than RA, and the treatments may differ. This uncertainty means that laboratory tests and imaging studies must be ordered. There is not currently any clear consensus to guide physicians in choosing a workup to diagnose early arthritis. Moreover, there is not enough scientific evidence available to enable recommendations to be developed rapidly. Previous studies have shown a wide variation in physicians' workup practices (6,7). These variations can have many origins, such as patient characteristics, individual practice style, physician uncertainty, or specific practice incentives (7–10). Moreover, it has been shown that these practice variations could have a substantial impact on costs (7).

The substantial economic impact of musculoskeletal disorders in developed countries is now well recognized: 0.8–3.4% of the Gross Domestic Product (11–14). RA is the second most costly joint disease, after osteoarthritis (15). Its annual direct costs are estimated between 2,300 and 6,700 €, i.e., between $2,000 and $6,000 US (15–19). Al-

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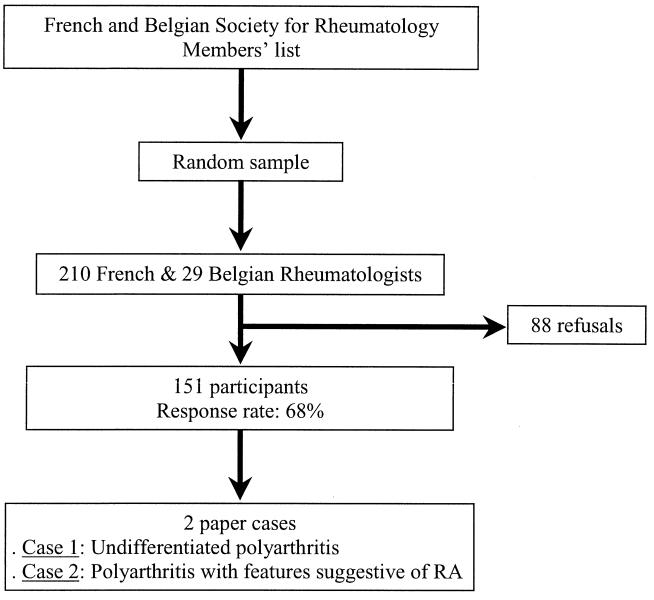

Figure 1. Study design.

though in the long run the costs of workups are less than those for medication or hospitalization (16,17,19–23), they can be quite substantial in the early phase, during the first months of the disease (18,24).

To facilitate a future evaluation of medical practice and promote a better understanding of physicians' behavior, we conducted a survey among a representative sample of rheumatologists in France and Belgium to determine their usual practices in ordering workups to diagnose recent-onset polyarthritis. After an initial study of the type of workups suggested (6), we conducted a second analysis to determine the costs of these tests and their major determinants.

SUBJECTS AND METHODS

Design and respondents. A survey was conducted during the year 2000 in France and in the French-speaking part of Belgium to characterize the practices and prescription habits of rheumatologists in the diagnosis of recent-onset (i.e., <1 year) polyarthritis (6). To determine the sample size, we first calculated the number of rheumatologists required to obtain a 10% precision, with an α risk set at 5% and a good feasibility (6), that is, 100. We assumed a 50% response rate for the mail survey. A random sample of 210 rheumatologists was thus selected from the membership list of the French Society for Rheumatology, and 29 from the Belgian Society. This sample represents ~10% of the members of the 2 societies. Selected physicians received an introductory letter with a 2-part questionnaire. A second letter and finally a telephone call followed in case of nonresponse (Figure 1). F1

Questionnaire. The questionnaire was divided in 2 parts, corresponding to 2 scenarios or vignettes drafted by a group of experts in systemic articular diseases. They were designed to evaluate physicians' practice habits at 2 different levels of clinical certainty or doubt (see Appendix A). The first case concerned a woman with recent-onset polyarthritis with no associated signs: RA and several other diagnoses were possible (possible RA). Case 2 described a patient with recent-onset polyarthritis already positive for rheumatoid factor: RA was very likely (probable RA). For each hypothetical case, respondents were asked to propose 1 or more possible diagnoses, to rank them by likelihood, and to indicate on a 0–10 scale their level of confidence in the diagnosis they considered most likely. They then listed the components of the workup that they would order (hematology, microbiology, immunology, imaging, other physician referral, or others), either in first or second line, to reach a diagnosis. Additional information about the rheumatologist was collected: medical education, year of diploma, duration and type of practice (private clinic, hospital, or mixed), and location (8 regions: north, Paris and suburbs, east, west, center, southeast, southwest, and Belgium).

Determination of costs. The cost study has been conducted from a payor perspective. The costing of the different workups ordered was based on the fee of the French national health insurance system, the CNAMTS (Caisse Nationale d'Assurance Maladie des Travailleurs Salariés). These prices are applicable for all workups, performed in either a public hospital or a private clinic; their reimbursement is supported by either the national health insurance or private insurances, depending on the patient's medical and socioeconomic status. These prices can be found in 2 public databases: the NGAP (Nomenclature Générales des Actes Professionnels) for medical consultations and imaging; and the NABM (Nomenclature des Actes de Biologie Médicale) for laboratory tests. These prices are presented in Appendix B. To facilitate this comparison, the French costs were also applied to the Belgian data. All prices are expressed in 2001 euro (1 € ≈ $1 US). Total costs were classified into 6 main categories: hemobiology and biochemistry, microbiology, immunology, imaging, medical consultation, and other.

Statistical analysis. All analyses were performed with STATA release 5 software (Stata Corp, College Station, TX). Mean costs and standard deviations were determined globally for the entire sample of respondents and all workups, as well as according to subgroups. For comparison, 95% confidence intervals and an analysis of variance were used. The effect of diagnostic doubt on costs was investigated by linear regression between the total costs and the variables in the questionnaire.

RESULTS

Respondent population. Of the 239 rheumatologists asked to participate in the study, 151 (63%) completed the questionnaire (Figure 1). Eighty-eight physicians did not respond: 19 had no clinical practice, 17 had no patients with inflammatory arthritis, 6 refused to participate for personal reasons, and 47 never returned the questionnaire, despite initial agreement. AQ: 4 AQ: 5

Table 1. Costs of workups for the diagnosis of early polyarthritis

	Case 1 (possible RA)			Case 2 (Probable RA)			
	Number of tests mean ± SD (median)	€ mean ± SD (95% CI)*	%	Number of tests mean ± SD (median)	€	%	*P*
Total costs		406.5 ± 194.3 (375.5, 437.5)			280.7 ± 154.3 (256.0, 305.2)		<0.0001
Hematology	5.2 ± 3.2 (5)	40.4 ± 26.3 (36.2, 44.6)	9.9	5.6 ± 3.5 (5)	41.5 ± 29.0 (36.2, 44.6)	14.8	
Microbiology	1.2 ± 1.7 (0)	20.7 ± 31.2 (15.7, 25.7)	5.1	0.3 ± 1.0 (0)	6.2 ± 17.6 (3.4, 9.0)	2.2	
Immunology	4.0 ± 1.3 (4)	164.8 ± 86.3 (151.0, 178.6)	40.6	2.8 ± 1.6 (3)	77.2 ± 91.6 (62.6, 91.8)	27.5	
Imaging	3.5 ± 1.5 (4)	152.7 ± 133.2 (131.5, 173.9)	37.6	2.9 ± 1.2 (3)	106.5 ± 91.0 (92.0, 121.0)	37.9	
Medical advice	0.1 ± 0.4 (0)	2.9 ± 8.9 (1.5, 4.3)	0.7	0.2 ± 0.4 (0)	3.4 ± 9.0 (2.0, 4.8)	1.2	
Other	0.5 ± 0.6 (0)	25.0 ± 35.9 (19.3, 30.7)	6.1	0.9 ± 0.4 (1)	45.9 ± 21.9 (42.4, 49.4)	16.4	

* 95% CI = 95% confidence interval.

Costs of workups. The mean ± SD total cost of the workup to diagnose early arthritis was 406.5 ± 194.3 € for case 1 and 280.7 ± 154.3 € for case 2 (Table 1). As expected, the cost was significantly higher in case 1 (the 95% confidence intervals do not overlap); the absence of diagnostic clues multiplied the costs by ~1.5. The extra costs were related to 3 categories: microbiology tests performed to rule out infection-related polyarthritis (either bacterial, viral, or reactive), immunologic tests to identify other autoimmune disorders (autoantibodies and sometimes HLA typing), and imaging (ultrasound, magnetic resonance imaging, or bone scan). Surprisingly, workups in the "other" category were significantly more expensive in case 2; this category included joint aspiration, biopsy, and digestive endoscopy, but the cost was due primarily to more frequent synovial fluid analyses. Because of the substantial variations of prescriptions, it was not possible to isolate any specific cost-driving workup within each category. These patterns did not differ for any of the physicians' characteristics, duration or region of practice, or the site of medical education.

Determinants of costs. Diagnostic test costs were higher for hospital physicians compared with rheumatologists in private practice (Table 2). For case 1, costs also tended to fall as physician experience increased: those physicians practicing for <5 years had the highest costs, and those practicing for >20 years the lowest (Table 2). Because of substantial interphysician variability, this trend was not statistically significant. There was no association between costs and the sites of medical education or practice, in either the univariate or multivariate analyses (data not shown).

Influence of diagnostic doubt on workup costs. Case 1 was associated with significantly higher costs than case 2, which is most probably due to diagnostic doubt. This was confirmed by the mean ± SD number of proposed diagnoses, also significantly higher for case 1 than case 2: 4.5 ± 1.5 versus 2.6 ± 1.5 (Table 3). Moreover, the level of confidence or certainty (on a 0–10 scale of increasing confidence) for the diagnosis reported as the most likely was significantly lower in case 1: 6.2 ± 1.7 versus 8.2 ± 1.3. Workup costs for both cases were positively correlated with the number of proposed diagnoses and inversely correlated with the level of diagnostic certainty. The multivariate analysis incorporating these 2 variables showed that only the number of proposed diagnoses was statistically correlated with costs (Table 3). The β coefficients indicate that the additional cost incurred per additional proposed diagnosis was 26.1 € for case 1 and 35.8 € for case 2.

Table 2. Cost variations according to type of practice

	Case 1 (Case without diagnostic clue) € mean ± SD (95% CI)	Case 2 (Case with diagnostic clue) € mean ± SD (95% CI)*	*P*
Clinical practice			
Private (n = 56)	382.9 ± 189.7 (332.1, 433.7)	256.9 ± 145.9 (217.9, 296.0)	0.001*†
Mixed (n = 40)	352.4 ± 139.5 (308.4, 396.4)	256.6 ± 147.7 (209.4, 303.9)	
Hospital (n = 43)	482.5 ± 214.8 (416.4, 548.6)	332.3 ± 170.1 (279.9, 384.6)	
Time in practice			
<5 years (n = 18)	467.1 ± 199.0 (375.2, 559.0)	293.0 ± 167.9 (215.4, 370.6)	0.9
6–10 years (n = 28)	436.5 ± 214.9 (356.9, 516.1)	301.9 ± 172.9 (237.9, 365.9)	
11–20 years (n = 57)	382.3 ± 168.5 (338.6, 426.0)	262.9 ± 144.9 (225.3, 300.5)	
21–30 years (n = 25)	397.2 ± 205.8 (318.1, 476.3)	243.5 ± 111.5 (199.8, 287.2)	
31–40 years (n = 11)	373.6 ± 267.8 (215.3, 531.9)	321.3 ± 171.3 (215.1, 427.5)	

* 95% CI = 95% confidence interval.
† Between private and public: $P = 0.04$; between mixed and public: $P = 0.003$; between private and mixed: $P = 0.3$.

Table 3. Impact of diagnostic uncertainty on costs.

	Case 1 (Case without diagnostic clue)		Case 2 (Case with diagnostic clue)	
	mean ± SD	β*	mean	β*
Number of diagnoses proposed by respondents	4.1 ± 1.5	26.1 (5.2, 47.1)	2.6 ± 1.5	19.1 (2.9, 35.2)
Diagnostic certainty (scale 0–10)	6.2 ± 1.7	−15.2 (−34.4, 4.0)	8.2 ± 1.3	−15.5 (−30.2, −0.9)
Intercept		395.0		297.0

* β is the coefficient of the linear regression. Values within parentheses correspond to the 95% confidence interval.

DISCUSSION

This report provides estimates of the costs of workups for the diagnosis of early polyarthritis in France and Belgium. It confirms that diagnostic workups are quite expensive, even though they do not represent most of the direct costs of early arthritis (15–19). Immunology tests and imaging are the 2 most costly categories. These costs varied widely, thereby confirming the enormous heterogeneity in physicians' practices observed in the first part of the study (6).

It is difficult, however, to determine if these expenditures are appropriate or excessive, because there is no clear consensus on the diagnostic process for recent-onset polyarthritis. Comparisons with previous estimates are also complex, because most published studies have focused on annual costs and not specifically on the question of diagnostic costs (15–19,24). Since our primary goal was to evaluate rheumatologists' prescription practices, we focused on the costs of outpatient diagnostic workups and did not include other costs, such as those of hospitalization, transportation, or time missed from work. For this kind of patient, these workups consist mainly of outpatient testing. These values may, however, constitute an underestimate of the costs of managing recent-onset polyarthritis during its diagnostic phase.

One strength of this work is that the participants of the present survey are representative of rheumatologists practicing in France and the French-speaking part of Belgium. The 2 scenarios used for the study correspond to the 2 most common presentations of early polyarthritis patients. These points reinforce the reliability of our findings. Written case simulations have sometimes been criticized because they may reflect theoretical knowledge or medical competence more than real-life practice. To limit this possible bias, we asked respondents to complete the questionnaire in accordance with their daily practice and not the theoretical practice taught in medical school. Moreover, a prospective trial has recently validated this methodology in the evaluation of physicians' practices; vignettes provide information highly consistent with real-life clinical practice (25).

We found no relation between geography of medical education or practice and workup practices. Because of the large number of medical schools in France and Belgium, medical schools and teaching hospitals had to be aggregated into wider geographic regions to obtain sufficient sample sizes for each group. It is thus impossible to rule out completely some effect by 1 of these 2 characteristics in diagnostic workup practices and their related costs. A trend toward a reduction of workup costs as medical experience increases (assessed by duration of medical practice) was observed for both cases but was not statistically significant in either the univariate or multivariate analyses. Older physicians' more limited knowledge of recent immunologic tests is another potential explanation for this inverse association between costs and duration of practice.

The final analysis showed that the most important determinant of diagnostic workup costs is diagnostic doubt, estimated by the number of diagnoses proposed by the respondent. This pattern was observed for both cases. Each additional diagnosis proposed by a respondent had an incremental cost of 26–35 €. Before the explosion in health care costs, it was standard practice to consider many diagnoses, even those relatively unlikely, and to order workups to confirm or rule out each. Nowadays, money is more limited and there are many more available tests, often quite expensive. The physician's task is thus more complex, to order a workup schedule according to the most likely diagnoses.

Future recommendations should define rules to help physicians organize their hypotheses and prescriptions according to the probability of the various diagnoses. Previous guidelines in other fields—for low back pain, for example—already use this strategy. These guidelines do not always result in cost reductions, however (26).

By emphasizing the impact of doubt in physicians' behavior, this study provides useful direction for recommendations for the diagnosis of early arthritis, currently under development by the Club Rhumatisme & Inflammation expert group. As already proposed (9,27), these guidelines should bear in mind the importance of helping physicians to balance the potential diagnoses and to determine the most reasonable tests to perform and their order for patients with early arthritis.

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APPENDIX A: CASE VIGNETTES

Case 1 (without diagnostic clues)

A 32-year-old woman consults, complaining of joint symptoms for the past 3 months. Her medical history is unremarkable, and she has not been taking medications on a regular basis. Her first symptoms were inflammatory pain and swelling in the right knee. The erythrocyte sedimentation rate and C-reactive protein level are normal. Nonsteroidal antiinflammatory drug therapy was given for 1 month before the visit, to no effect. A corticosteroid was injected into the knee. Symptoms in the past month were inflammatory pain (with night pain and 2 hours of morning stiffness) in the knees, wrists, right second and third metacarpophalangeal joints, and right ankle.

She denies any intercurrent or precipitating event and reports no cutaneous, stomatologic, ophthalmologic, gastrointestinal, or urinary symptoms. The physical examination shows arthritis of the wrists, right second and third metacarpophalangeal joints, and knees, with no extraarticular abnormalities.

Case 2 (with diagnostic clues)

A 48-year-old woman consults, complaining of a 3-month history of inflammatory pain with swelling in the wrists; first, second, third, and fourth metacarpophalangeal joints of both hands; second, third, and fourth proximal interphalangeal joints of both hands; and right knee. She has no history of significant disease and has not been taking medications on a regular basis. She denies any intercurrent or precipitating event and says she has no history of cutaneous, stomatologic, ophthalmologic, gastrointestinal, or urinary symptoms. The physical examination shows marked arthritis of the above-listed joints, with no extraarticular abnormalities. She shows you a laboratory report indicating that a latex test for rheumatoid factor was positive in a titer of 1/160.

Please answer the following questions for each of these cases:

1) List the diagnoses you suspect, in decreasing order of likelihood. On an 11-point scale (0-10), rate your degree of certainty that the patient has the first diagnosis on your list.

2) Would you order imaging studies? If yes, which?

3) Would you order laboratory tests? If yes, which?

4) Would you order other diagnostic tests? If yes, which? **APP-B**

APPENDIX B: MAIN WORKUPS PRICES IN 2001 EUROS*

Test	Letter and coefficient	2001 euros
Hemogram	B 40	10.40
Erythrocyte sedimentation rate	B 10	2.60
C-reactive protein	B 50	13.00
Serum creatinin	B 10	2.60
24-hour proteinuria	B 8	2.08
Alcalin phosphatase	B 20	5.20
Gamma glutamyl transferase	B 20	5.20
Transaminases	B 25	6.50
Serum uric acid	B 10	2.60
Serum calcium	B 15	3.90
Serum muscular enzymes	B 60	15.60
Rheumatoid factor (2 different methods)	B 80	20.80
Autoantibodies		
antikeratin	B 40	10.40
antinuclear	B 40	10.40
anti-dsDNA	B 40	10.40
antisoluble nuclear antigens	B 70	18.20
antiphospholipids	B 70	18.20
ANCA	B 40	10.40
Complement	B 40	10.40
HLA–B27 (serology)	B 400	104.00
Cryoglobulinemia	B 20	5.20
Serologies		
hepatitis B virus	B 70	18.20
hepatitis C virus	B 70	18.20
Parvovirus B19	B 70	18.20
HIV	B 70	18.20
Other virus	B 70	18.20
Chlamydiae trachomatis	B 30	7.80
Angiotensin converting enzyme	B 60	15.60
Ferritin	B 60	15.60
Synovial aspiration	B 200	52.00
Joint radiographs		
Hands and wrists	Z 15	24.30
Pelvis/sacroiliac	Z 15	24.30
Spine	Z 45	72.90
Knee	Z 17	27.54
Feet	Z 30	48.60
Heel	Z 30	48.60
Chest radiograph	Z 16	25.92
Joint ultrasound	KE 20	37.80
Joint CT scan	Z 87	140.94
Bone scan	K 150	288.00
Joint MRI		329.75

* Each price is based on a key letter (B = 0.26 € for biological tests, Z = 1.62 € for imaging, KE = 1.89 for ultrasounds and K = 1.92 for bone scan) and a coefficient. The final price is based on the following equation: key-letter × coefficient. ANCA = antineutrophil cytoplasmic antibody; HIV = human immunodeficiency virus; CT = computed tomography; MRI = magnetic resonance image.

AQ1 Your manuscript was edited by Nancy Vickers, Managing Editor of *Arthritis Care & Research*, at the American College of Rheumatology in Atlanta. If you have any questions, please contact me by phone (404-633-3777 x 317), fax (404-633-1870), or e-mail (nvickers@rheumatology.org). You may also write your questions/comments on the proofs.

AQ2 Does the school of Public Health in Nancy have a name ? Is EA 3444 the same school ?

AQ3 Please spell out CHRU

AQ4 151/239 is 63% not 58%,

AQ5 These numbers add up to 89, please confirm data.

AQ6 Table 3 says 4.1, not 4.5 please confirm which is correct.