Rheumatol Int (2009) 29:897–905
DOI 10.1007/s00296-008-0804-4

ORIGINAL ARTICLE

Predictors of bone density testing in patients with rheumatoid arthritis

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Received: 22 April 2008 / Accepted: 3 September 2008 / Published online: 21 December 2008

Abstract Patients with rheumatoid arthritis (RA) are at increased risk of low bone density and fractures. This study identifies predictors of initiation of dual energy X-ray absorptiometry (DXA) testing in RA. We identified RA patients from the CORRONA registry with ≥1 year follow-up without reported DXA at study entry. The primary outcome was report of DXA in the first year of follow-up (DXA initiation). Variables associated with DXA initiation were considered for the multivariate model. Stepwise logistic regression identified independent predictors. Of the 2,717 RA patients without DXA documented at enrollment, 297 (11%) reported DXA initiation. Independent predictors of DXA initiation included age, female sex, history of fracture, steroid use, and physician's assessment of RA activity. In conclusion, DXA initiation in RA patients in the CORRONA cohort is low despite increased risk of osteoporosis. Predictors of DXA initiation include fracture, common risk factors for osteoporosis, and RA-associated factors.

Keywords Bone density · Education · Osteoporosis · Rheumatoid arthritis

Electronic supplementary material The online version of this article (doi:10.1007/s00296-008-0804-4) contains supplementary material, which is available to authorized users.

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Introduction

Risk of osteoporosis and consequent fractures is increased among patients with inflammatory arthritis such as rheumatoid arthritis (RA) [1]. The inflammation of RA can promote osteoclastogenesis and lead directly to both focal and generalized bone loss. In addition, many indirect factors associated with inflammatory arthritis contribute to osteoporosis risk. These include high rates of immobility, weight loss, and use of medications known to promote bone loss such as glucocorticoids.

General health care maintenance is often neglected in patients with chronic illnesses [2, 3]. Several studies have reported low performance scores for health care maintenance and care of comorbid diseases in patients with rheumatoid arthritis [4–6]. Recommended processes for evaluation and care of comorbid diseases including diabetes mellitus, heart disease, and gastrointestinal bleeding are performed only 52% of the time in patients with RA despite the fact that RA and its treatment are associated with increased risk for these conditions [4]. For example, despite an increased risk of serious infection, only 38% of patients with RA over the age of 65 reported pneumococcal vaccination within a 5 year follow up period [6]. Patients with RA or osteoarthritis are less likely to visit a dental professional compared with patients without arthritis [5].

The negative effects of glucocorticoids on bone turnover have been described and discussed in the rheumatology

literature. In 2001, the American College of Rheumatology (ACR) updated their published recommendations for the prevention and treatment of glucocorticoid induced osteoporosis (GiOP) [7]. Despite this, rates of bone density screening in patients with rheumatoid arthritis at risk for GiOP are low. Although rates of treatment for GiOP are higher for rheumatologists than for other subspecialists [8], rates remain inadequate, with only 23% of patients with RA at risk for GiOP receiving bone density testing in a single academic rheumatology practice [9].

Patients with RA remain at a higher risk of fracture than the general population, even without chronic glucocorticoid use [10]. Organizations including the International Society for Clinical Densitometry (ISCD) and the NOF recommend dual energy X-ray absorptiometry (DXA) testing for all adults with RA, in addition to all women over age 65, all adults who have sustained a fracture after age 50 or a fragility fracture, anyone on chronic glucocorticoids, and other patients at high risk of low bone mass, bone loss, or fracture [11–14]. The World Health Organization (WHO) has recently developed and released an algorithm to assist in estimation of the 10-year absolute fracture risk for individual patients based on a combination of clinical risk factors for fracture, including rheumatoid arthritis, as well as DXA results [15, 16]. The International Osteoporosis Foundation (IOF) and the NOF have expressed strong support for the use of this tool in clinical decision making [17]. The NOF has concluded that treatment for osteoporosis is cost-effective in the United States of America for patients with a 10-year absolute risk of hip fracture of 3% or greater [18]. The addition of DXA results to clinical risk factors distinguishes patients with RA above and below this threshold of 3%, reinforcing the clinical importance of DXA testing in the RA population.

We suspect that although RA patients are at increased risk of osteoporosis, they often do not undergo appropriate bone mineral density (BMD) evaluation. To date, there are no data available on rates of bone density testing in the RA population, which are not focused exclusively on RA patients using glucocorticoids.

In patients with RA, lower level of education has been associated with less involvement in medical decision-making [19], poorer clinical status [20], higher rates of disability [21, 22], and premature mortality [23]. Patients with limited health literacy may have greater difficulty complying with physician referrals for bone density testing.

We sought to identify predictors of initiation of DXA testing in RA patients followed by rheumatologists across North America using the Consortium of Rheumatology Researchers of North America (CORRONA) database. The CORRONA database is a large, observational, longitudinal registry described in detail elsewhere [24] that includes clinical information collected from patients with inflammatory arthritis and their treating rheumatologists. Previous analyses of the CORRONA database have included evaluations of the use of pharmacologic agents in patients with arthritis [25–27].We hypothesized that level of education would be an independent predictor of DXA initiation in patients with RA in the CORRONA database.

Materials and methods

Study population

The Consortium of Rheumatology Researchers of North America (CORRONA) began collecting data in 2002 [24]. Briefly, the CORRONA database is a prospective registry of adult patients with RA, psoriatic arthritis, and juvenile inflammatory arthritis under the care of rheumatologists. Its goal is to maintain an ongoing registry of clinical information on a large heterogeneous population of inflammatory arthritis patients that is independent of the pharmaceutical industry and will allow evaluation of long-term outcomes under naturalistic circumstances. Since March 2002, rheumatologists in academic centers as well as rheumatologists in private practice have joined the consortium. Approval for the CORRONA registry was obtained from the institutional review boards of participating academic sites and from a central private institutional review board for patients from private practice sites. Informed consent is obtained from patients at enrollment in the CORRONA registry. Data from enrolled patients are collected prospectively at regular intervals, as often as every three months, during routine clinical follow-up by a rheumatologist. As of 8/15/06, there were 6,143 patients with RA contributing $\geq$1 year follow-up to the CORRONA database. These data were collected from 212 rheumatologists at 76 sites across North America.

Our primary aim was to identify predictors of initiation of bone density testing in patients with rheumatoid arthritis. We identified the 2,717 RA patients with $\geq$1 year follow-up, including at least one follow up visit within the first year of enrollment, without reported DXA at study entry for our primary analysis.

For secondary analyses, we identified the 2,296 RA patients with $\geq$1 year follow-up without reported DXA at study entry who did not report any therapy for osteoporosis at enrollment. We also identified the 3,012 RA patients with $\geq$1 year follow-up with DXA at study entry.

Variables

The dependent variable for our primary analysis was defined as the report of DXA results during the first year of follow-up in the CORRONA database. We considered the following potential predictors: sex, age, insurance type,

education, marital status, disability status, ethnicity, race, BMI, smoking status, exercise frequency, swollen and tender joint counts, physician's assessment of disease activity, presence of joint deformity, ARA class, RA duration, history of fracture, family history of osteoporosis, family history of fracture over age 50, MHAQ score, presence of back pain within the prior eight weeks, number of comorbid conditions, thyroid disease, reported prednisone or medrol use in the prior 8 weeks, current number of disease modifying anti-rheumatic drugs (DMARDs), and prescription medication use for osteoporosis.

For time-dependent variables, including insurance type, disability status, amount of exercise, presence of joint deformities, ARA class, and presence of back pain within the prior eight weeks, data was used from the visit prior to the incident DXA. For subjects without incident DXA during the first year of follow up, data was used from the visit prior to one chosen at random. Subjects were considered to have had a history of fracture or a history of steroid use if they reported these during any visit prior to the incident DXA, or prior to the visit chosen at random for those subjects without incident DXA during the first year of follow up.

Statistical analysis

We examined the distribution of the variables for normality and presence of any outliers. Where appropriate, non-normally distributed continuous variables were dichotomized or categorized based on clinical understanding and pattern of distribution. Univariate associations of each variable of interest with incident DXA were identified. Those variables whose univariate associations trended toward significance (defined as $P < 0.1$) were considered for construction of the multivariate model. Stepwise logistic regression was performed to identify independent predictors of incident DXA ($P < 0.05$). Level of education was added to the regression model to evaluate a priori suspicion that patients with higher levels of education were more likely to receive DXAs as an element of health care maintenance screening. Bootstrapping techniques were used for internal validation of the primary model. All analyses were performed using STATA 9.0 (Stata Corporation, College Station, TX, USA). Categorical variables are presented as frequency and percent and compared with the Chi-square test. Normally distributed continuous variables are presented as mean ± standard deviation and compared with independent sample t-tests. Non-normally distributed continuous variables are presented as median and range, and compared with Wilcoxon rank sum tests.

The reported investigations were performed in accordance with the principles of the Declaration of Helsinki.

Results

Study population

Of the RA patients in the database with ≥1 year follow-up, 3,012 (45%) reported DXA upon entry. Of the 2,717 RA patients with ≥1 year follow-up without reported DXA at enrollment in CORRONA, 297 (11%) reported incident DXA during the first year of follow up (2,035 visits), and 2,420 (89%) did not report incident DXA during this period (16,147 visits) (Fig. 1).

The characteristics of RA patients with ≥1 year follow-up without reported DXA at enrollment are described in Table 1. Patients who reported initial bone density testing during the first year of registry follow up (DXA initiation) were more likely to be older, female, and have private insurance or Medicare. With respect to general health, DXA initiation was associated with a lower body mass index (BMI), lower number of comorbid conditions, report of recent (within 8 weeks) back pain, reported history of fracture, family history of osteoporosis, family history of fractures after age 50, and prescription medication use for osteoporosis. RA-related variables found to be associated with DXA initiation included history of steroid use, more swollen and tender joints, presence of joint deformities, worse overall function defined by ARA classification, greater disability as per higher MHAQ scores, and greater disease activity according to the physician's assessment.

RA patients with DXA reported at study entry differed from those who reported DXA initiation during the first year of registry follow-up in several significant ways (Table 2). Not surprisingly, patients reporting DXA at study entry were more likely to report receiving treatment for osteoporosis, Patients with DXA reported at study entry were more likely to be over 70 or younger than

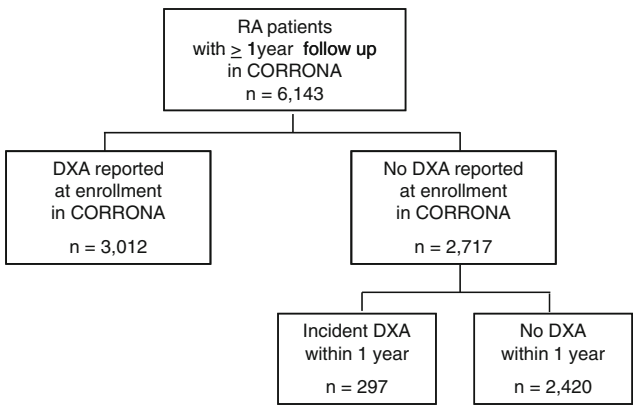

Fig. 1 RA patients with ≥1 year follow up in the CORRONA registry, *RA* rheumatoid arthritis, *CORRONA* Consortium of Rheumatology Researchers of North America, *DXA* dual energy X-ray absorptiometry

Table 1 Population characteristics and univariate analysis of patients with rheumatoid arthritis in the CORRONA database with at least 1 year of follow up

Characteristic	Incident DXA $n = 297$	No Incident DXA $n = 2,420$	P value[a]	P value[b]
Age				
<40	7 (19)	13 (296)	<0.01	NA
40–50	16 (43)	23 (537)		0.44
50–60	31 (86)	29 (678)		0.01
60–70	29 (81)	21 (488)		<0.01
>70	17 (47)	15 (356)		0.01
Female	80 (225)	63 (1,504)	<0.01	<0.01
Race				
White	97 (259)	94 (2,184)	0.34	NA
Black	3 (8)	4 (99)		0.30
Asian	0.4 (1)	1.2 (28)		0.24
Ethnicity				
Hispanic	11 (26)	9 (152)	0.27	0.26
Insurance				
Private	76 (222)	80 (1,916)	0.08	0.07
Medicare	38 (113)	29 (698)	0.01	<0.01
Medicaid	5 (15)	5 (114)	0.77	0.80
Final education				
Primary	7 (18)	7 (155)	0.56	NA
Secondary	44 (118)	39 (894)		0.63
College/University	49 (133)	53 (1,212)		0.83
Unknown	0.4 (1)	0.5 (12)		0.76
Disabled	13 (39)	11 (270)	0.29	0.29
Married	68 (198)	72 (1728)	0.12	0.11
Smoker	15 (45)	18 (425)	0.29	0.26
Body mass index (BMI)	27.5 (18.4–51.1)	28.2 (14.1–71.3)	0.06	0.06
Exercise				
Not at all	32 (91)	29 (671)	0.76	NA
1–2 times per week	31 (88)	32 (744)		0.39
3–4 times per week	20 (56)	21 (490)		0.34
>4 times per week	18 (51)	17 (398)		0.76
Thyroid disease	16 (45)	15 (352)	0.53	0.53
Number of comorbid conditions	1 (0–6)	1 (0–10)	<0.01	<0.01
History of fracture	26 (78)	18 (426)	<0.01	<0.01
Family history of osteoporosis	18 (55)	13 (324)	0.02	0.02
Family history of fractures after age 50	15 (44)	10 (244)	0.02	0.01
Any therapy for osteoporosis	23 (68)	15 (353)	<0.01	<0.01
Duration of RA > 5 years	59 (173)	55 (1,333)	0.32	0.30
Current number of DMARDs	1 (0–4)	1 (0–6)	0.38	0.25
History of steroid use	46 (138)	38 (925)	<0.01	<0.01
Joint deformity	34 (100)	29 (680)	0.06	0.05
Functional class				
I	36 (101)	48 (1,126)	<0.01	NA
II	50 (142)	42 (992)		<0.01
III	12 (34)	9 (224)		0.01
IV	1 (4)	1 (24)		0.26

Table 1 continued

Characteristic	Incident DXA n = 297	No Incident DXA n = 2,420	P value[a]	P value[b]
MHAQ score	0.19 (0–2.5)	0.13 (0–2.63)	0.02	<0.01
Physician's assessment of disease activity	28 (0–96)	20 (0–100)	<0.01	<0.01
Swollen joint count	4 (0–26)	3 (0–28)	0.08	0.73
Tender joint count	3 (0–28)	2 (0–28)	<0.01	<0.01
Back Pain	36 (108)	29 (699)	<0.01	<0.01

DXA dual energy X-ray absorptiometry, *RA* rheumatoid arthritis, *DMARDs* disease modifying anti-rheumatic drugs, *MHAQ* modified health assessment questionnaire

[a] For continuous, normally distributed variables mean ± standard deviation presented, with P values from t tests, for continuous non-normally distributed variables median (range) presented with P values from Wilcoxon rank sum tests, for categorical variables frequency in % (n) presented with P values from Chi-square analyses

[b] Univariate analysis

Table 2 Population characteristics of rheumatoid arthritis patients reporting DXA at enrollment versus DXA during the first year of follow up in the CORRONA database

Characteristic	DXA at enrollment n = 3,012	Incident DXA n = 297	P value[a]
Age			
<40	3 (78)	7 (19)	<0.01
40–50	9 (259)	16 (43)	<0.01
50–60	28 (827)	31 (86)	0.30
60–70	30 (869)	29 (81)	1.00
>70	31 (902)	17 (47)	<0.01
Female	84 (2,526)	80 (225)	0.06
Race			
White	95 (2,742)	97 (259)	0.44
Black	4 (107)	3 (8)	0.73
Asian	0.9 (26)	0.4 (1)	0.72
Ethnicity			
Hispanic	9 (195)	11 (26)	0.23
Insurance			
Private	69 (2,062)	76 (222)	0.02
Medicare	52 (1,551)	38 (113)	<0.01
Medicaid	6 (174)	5 (15)	0.70
Final education			
Primary	7 (190)	7 (18)	1.00
Secondary	48 (1,370)	44 (118)	0.20
College/University	45 (1,278)	49 (133)	0.16
Unknown	0.8 (23)	0.4 (1)	0.72
Disabled	16 (481)	13 (39)	0.21
Married	67 (2,017)	68 (198)	1.00
Smoker	14 (411)	15 (45)	0.48
Body mass index (BMI)	27.2 (13.9–68.8)	27.5 (18.4–51.1)	0.30
Exercise			
Not at all	31 (900)	32 (91)	0.79
1–2 times per week	30 (856)	31 (88)	0.68
3–4 times per week	21 (599)	20 (56)	0.70
>4 times per week	19 (542)	18 (51)	0.75
Thyroid disease	22 (648)	16 (45)	0.03

Table 2 continued

Characteristic	DXA at enrollment $n = 3,012$	Incident DXA $n = 297$	P value[a]
Number of comorbid conditions	1 (0–7)	1 (0–6)	<0.01
History of fracture	25 (767)	26 (78)	0.78
Family history of osteoporosis	22 (675)	18 (55)	0.14
Family history of fractures after age 50	14 (421)	15 (44)	0.66
Any therapy for osteoporosis	49 (1,468)	23 (68)	<0.01
Duration of RA > 5 years	75 (2,241)	59 (173)	<0.01
Current number of DMARDs	1 (0–6)	1 (0–4)	0.25
History of steroid use	45 (1,284)	46 (138)	0.54
Joint deformity	43 (1,277)	34 (100)	<0.01
Functional class			
I	33 (988)	36 (101)	0.39
II	50 (1,467)	50 (142)	0.80
III	15 (457)	12 (34)	0.14
IV	1.5 (45)	1 (4)	1.00
MHAQ score	0.13 (0–2.88)	0.19 (0–2.5)	0.75
Physician's assessment of disease activity	21 (0–100)	28 (0–96)	<0.01
Swollen joint count	3 (0–28)	4 (0–26)	0.03
Tender joint count	2 (0–28)	3 (0–28)	<0.01
Back pain	35 (1,064)	36 (108)	0.75

DXA dual energy X-ray absorptiometry, *RA* rheumatoid arthritis, *DMARDs* disease modifying anti-rheumatic drugs, *MHAQ* modified health assessment questionnaire

[a] For continuous, normally distributed variables mean ± standard deviation presented, with P values from t tests, for continuous non-normally distributed variables median (range) presented with P values from Wilcoxon rank sum tests, for categorical variables frequency in % (n) presented with P values from Chi-square analyses

50 years old. Perhaps at least partly related to this, patients with DXA reported at study entry were more likely to have greater numbers of comorbid diseases, thyroid disease, and Medicare insurance, and less likely to have private insurance. Patients reporting DXA at study entry were more likely to have had RA for over 5 years and to have joint deformities, but were less likely to have higher scores on measures of RA activity including physician's assessment of disease activity, swollen and tender joint counts.

Of the total 6,185 RA patients with ≥1 year follow-up, 1,353 (22%) are women over age 65 at enrollment. Of these, 1,006 (74%) reported DXA at enrollment. An additional 52 of these women over age 65 at enrollment reported incident DXA during the first year of follow up in CORRONA. These women accounted for 18% of the total number of incident DXAs in this study. Of RA patients without DXA at enrollment who reported the use of steroids during the first year of follow-up, only 13% reported bone density testing during that period.

RA patients with ≥1 year follow-up without reported DXA at study entry and not reporting any therapy for osteoporosis at enrollment were subsequently identified and separately analyzed. While most predictors identified in the primary analysis remained significant, rates of private insurance, BMI, and swollen joint counts were not associated with DXA initiation.

Univariate associations

Significant ($P < 0.05$) associations were found between DXA initiation and each of the following variables: female sex, age, Medicare insurance, RA duration, ARA class, joint deformity, physician assessment of RA activity, tender joint count, MHAQ score, number of comorbid conditions, history of fracture, family history of osteoporosis, family history of fracture after age 50, back pain, steroid use, and osteoporosis medication use (Table 1). In addition, univariate associations with DXA initiation with p values between 0.05 and 0.1 were found for BMI and private insurance in the primary analysis, although not in the cohort, which excluded patients reporting use of osteoporosis treatments at enrollment. Level of education was not significantly associated with DXA initiation in univariate analysis.

Multivariate associations

Forward and backward stepwise regression models were convergent. Significant independent predictors of DXA

Table 3 Multivariate analysis: variables independently associated with DXA initiation

Variable	OR	95% Confidence interval	*P* value
Age			
<40	1	NA	NA
40–50	1.37	0.78–2.41	0.27
50–60	2.34	1.39–3.94	<0.01
60–70	3.27	1.92–5.56	<0.01
>70	2.61	1.48–4.61	<0.01
Female	2.86	2.08–3.93	<0.01
History of fracture	1.83	1.36–2.46	<0.01
History of steroid use	1.38	1.06–1.80	0.02
Physician's assessment of disease activity	1.01	1.00–1.01	0.02

OR odds ratio, *NA* not applicable

Table 4 Multivariate analysis excluding patients reporting treatment for osteoporosis at enrollment

Variable	OR	95% Confidence interval	*P* value
Age			
<40	1	NA	NA
40–50	1.30	0.73–2.32	0.37
50–60	2.06	1.19–3.55	<0.01
60–70	3.57	2.05–6.21	<0.01
>70	3.21	1.76–5.86	<0.01
Female	3.27	2.31–4.62	<0.01
History of fracture	2.07	1.48–2.88	<0.01
History of steroid use	1.40	1.04–1.88	0.02
Physician's assessment of disease activity	1.01	1.00–1.02	<0.01

OR odds ratio, *NA* not applicable

initiation were age over 50, female sex, history of fracture, reported steroid use, and physician assessment of disease activity (Table 3). Level of education was not significantly associated with DXA initiation in multivariate analysis.

Excluding patients reporting use of osteoporosis medications at enrollment did not alter the variables considered in the stepwise analysis, nor did it alter the composition of the multivariate model (Table 4).

Bootstrapping validation techniques confirmed the variables identified in the stepwise analyses.

Discussion

The present study is the first to present data on rates of bone density testing in a large cohort of patients with RA. At the time of this analysis, the CORRONA registry contained at least one year of data on 6,143 patients with RA followed by rheumatologists across North America. At study entry, 55% of these patients reported no previous bone density testing. Only 11% of these reported initiation of bone density testing within the following year.

The increased risk of osteoporotic fractures in patients with RA has been appreciated and acknowledged in recommendations of relevant societies including the WHO, the IOF, the NOF, and the ISCD. Various guidelines share the common recommendation for bone density testing in all women over age 65, and all post-menopausal women with additional fracture risk factors including conditions such as RA. In addition, the ACR has published recommendations for bone density testing of all patients receiving, or anticipating treatment with, glucocorticoids for at least 3 months.

Despite these recommendations, a significant percentage of RA patients with multiple risk factors for fracture translating into multiple indications for bone density testing are not reporting bone density testing, despite regular visits to rheumatologists. In this large cohort, 26% of female RA patients over age 65 did not report bone density testing at enrollment, and only 18% of these reported incident DXA in the first year of follow up. Only 13% of RA patients reporting glucocorticoid use during the first year of follow up reported DXA during that period.

Increasing age is an independent predictor of DXA initiation in this cohort up to 70 years of age. Given the major importance of age, without upper limit, as a predictor of osteoporosis and fracture risk, the decrease in odds ratio for DXA initiation in patients over age 70 is counter to what evidence would recommend. The fact that this finding remained after excluding patients reporting use of prescription osteoporosis medication from the analysis suggests that physicians are not simply treating their more elderly patients empirically and forgoing DXA testing. Since the cohort reporting DXA at enrollment had a higher proportion of patients over age 70, perhaps those patients in this age group being considered for DXA have already been referred for bone density testing, and additional referrals, or compliance with referrals, in this group is less likely. In contrast, in the prior decade, perhaps as patients reach 65 years old, rates of referrals may rise.

The identification of history of fracture as a predictor of DXA initiation may suggest we are waiting too long to detect and treat low bone mass and fracture risk in this population. Perhaps if bone density testing were performed earlier it may have prompted treatment for low bone mass and some of these fractures might have been prevented.

Physician assessment of disease activity is an independent predictor of DXA initiation. The magnitude of this

effect was small but it suggests several interesting clinical scenarios. It is possible that physicians are more concerned with the skeletal health of patients whom they perceive to have more active disease. This concern may be derived from a direct concern about the affect of active rheumatoid arthritis on bone density. Alternatively, this concern may relate to physician's understanding of the risk of glucocorticoid induced osteoporosis. The physicians may have the belief, accurate or otherwise, that these patients have received or will receive more steroids than those with less active disease. It is also possible that patients whose doctors report higher levels of disease activity are more compliant with DXA referrals, perhaps related to having greater concern for their personal skeletal health.

Surprisingly, level of education was not identified as an independent predictor of DXA initiation. The relatively high level of education in this population may account for the lack of any association between level of education and bone density testing. It is also possible that health literacy, rather than simply self-reported level of education, may be a more appropriate measure.

Some limitations of the study warrant discussion. This study does not address the reasons patients have not had DXAs performed. Physicians may not be referring patients for DXAs due to young age, contraindications such as pregnancy, or lack of knowledge. Efforts have been made to try to improve physician knowledge of risk factors for low bone mass. Guidelines for bone density screening have not been uniform, which may contribute to confusion about who should be screened. Some patients may be non-compliant with physician referrals. Factors contributing to patient non-compliance with bone density testing referrals have not been extensively evaluated. It is also possible that some patients have had DXAs but the results were not provided in the data collection for the CORRONA registry. Furthermore, due to the constraints of the registry, data on menopausal status and comprehensive glucocorticoid exposure are not available. While the CORRONA registry collects data on patients across the United States, only a fraction of all patients with rheumatoid arthritis are captured in this registry. As a result, the findings in this study may not reflect rates of DXA testing in patients not included in the CORRONA registry.

In conclusion, over half of patients with RA participating in the CORRONA registry have not reported bone density testing at enrollment. Rates of initiation of bone density testing in this population are low, only 11% within one year. Fracture history is a strong independent predictor of initiation of bone density testing suggesting missed opportunities for prevention. Female sex and increasing age, both common risk factors for osteoporosis in the general population, are additional independent predictors; however, the bone health of younger patients and men with rheumatoid arthritis must not be overlooked. The finding that physician's assessment of disease activity was an independent predictor of DXA initiation suggests that perhaps perceptions of physicians and/or patients can influence performance of bone density testing. Although steroid use was an independent predictor of bone density testing, DXA initiation in this population remains low. It is clear that bone density testing of patients with RA falls short of recommendations, even in particularly high risk groups.

Acknowledgments The authors thank Dr. Allan Gibofsky for his input on the manuscript and Dr. Stephen Paget for his support.

Conflict of interest statement Dr. J. Aizer received support from a CORRONA Fellowship Award. Dr. G. Reed has a research contract with CORRONA through University of Massachusetts. Dr. M.J. Harrison received support from the Arthritis Foundation, the Mary Kirkland Foundation for Lupus Research, Wyeth, Amgen, Pfizer, and Bristol-Myers Squibb. Dr. M.J. Harrison is currently an employee of Wyeth Research. All research presented was conducted prior to her current employment. She received no Wyeth support for this work.

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