
Using an electronic platform interactively to improve treatment outcome in patients with rheumatoid arthritis: new developments from the DANBIO registry

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ABSTRACT

Objective. Electronic platforms have been developed to help the clinician monitor disease activity in rheumatoid arthritis (RA) to support a treat-to-target strategy. We present an initiative to interactively improve disease control in patients with rheumatoid arthritis.

Methods. In patients who presented with one or more swollen joints AND moderate/high disease activity (i.e. either CDAI \geq 10.1 and/or DAS28CRP $>$ 3.2, which is automatically calculated in the DANBIO registry), a red alert was shown, which activated a pop-up: "This patient has at least one swollen joint AND either CDAI \geq 10.1 or DAS28CRP $>$ 3.2. Which action do you as a physician take today: Intensify treatment, Treatment intensification is not possible currently/awaiting results of additional investigations, No further treatment intensification is possible, The patient does not want to intensify treatment, Other decisions taken"

Results. Of 21,056 patients with RA, 40% fulfilled the criteria for getting the alert message. The pop-up was activated and completed by the physician in 65% of those (5,428 patients). Treatment was intensified in 67%. In 2% of patients, no additional treatment intensification was possible, and 8% of the patients objected to intensification.

Conclusion. In >8,000 RA patients who presented with objective signs of active disease in routine care, an interactive feature of the DANBIO registry was introduced, which prompted the physician to take action and consider treatment intensification. In two-thirds of the cases, the treating physician reported that treatment was intensified.

Introduction

The DANBIO registry is a Danish nationwide collaborative effort of Danish

rheumatologists established almost 15 years ago (1, 2). An electronic version with various tools replaced a paper version more than a decade ago. DANBIO was designed for electronic capture of patient-reported and physician measures, as well as laboratory tests, imaging, and treatments, in routine monitoring, with the ultimate goal of improving long-term outcomes (1).

In recent years, control of RA disease activity has improved significantly and steadily (3), guided in part by a treat-to-target strategy embodied in treatment recommendations. DANBIO and other electronic systems offer an automatic calculation of DAS28, CDAI etc., which gives an overview over the actual and historical status of the disease course in individual patients (Fig. 1). At this time, remission or low disease activity is not only an option, but has also been achieved in the majority of patients in the DANBIO registry (4) (homepage on the Internet).

Although disease control has improved significantly in most patients, disease remains insufficiently controlled in a subgroup of patients, who continue to have one or several swollen joints and moderate-high disease activity despite treatment. It appeared of value to increase physician's awareness of this patient group by introducing a pop-up message encouraging the physician to actively consider treatment intensification in patients with evidence of inflammatory activity. This is the next step forward in the use of electronic data capture thus not only to collect and present data, but also to interact actively with the physician. This process could also facilitate analysis of possible complexities in implementation of the treat-to-target principle in certain patients. For example, Tymms *et al.* (5) have reported using a pop-up reminder

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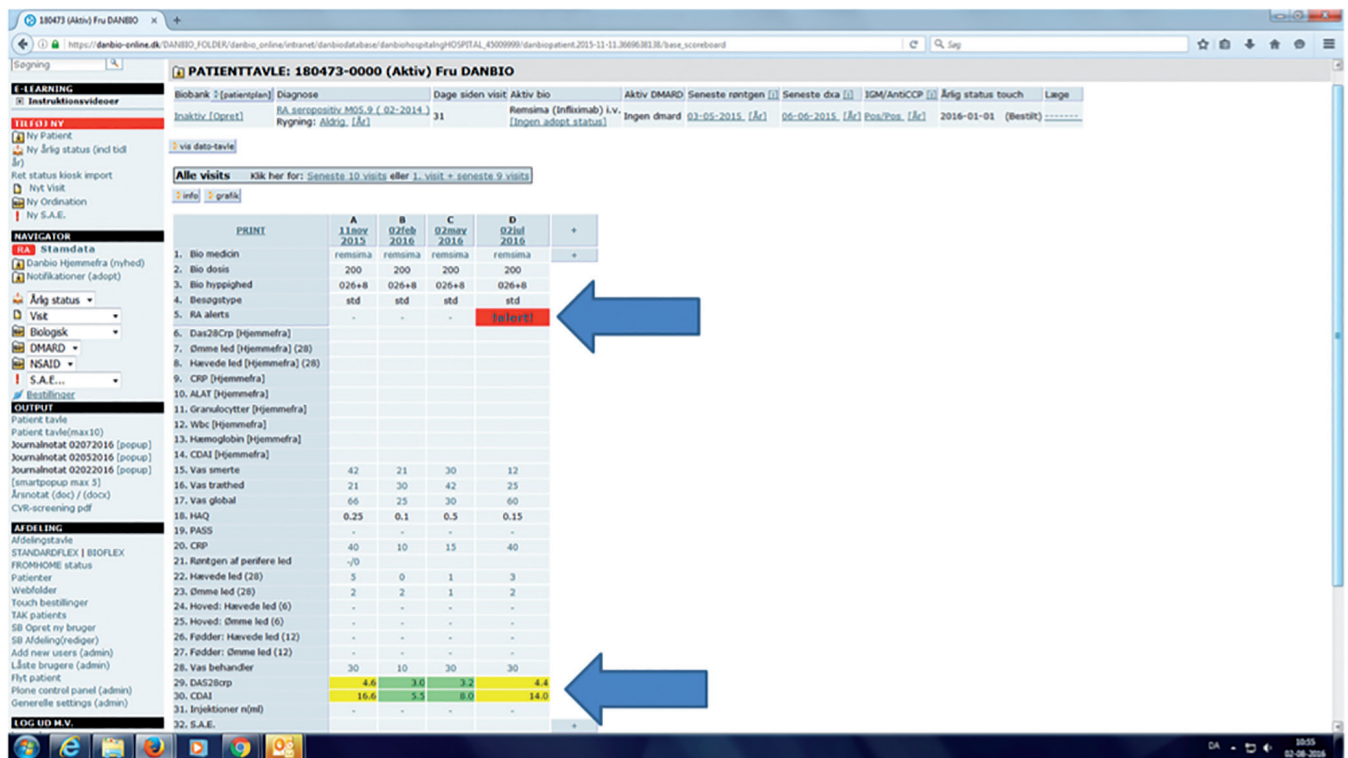


Fig. 1. The DANBIO score board shows (bottom) DAS28CRP and CDAI scores at each visit. The new, interactive feature (top blue arrow) is activated if there is one or more swollen joints and moderate/high disease activity as measured by DAS28CRP or CDAI (yellow or red) (bottom blue arrow).

in RA patients who remained in high or moderate disease activity according to DAS28, despite treatment. Among 584 such patients, rheumatologists reported irreversible joint damage in 20%, patient-driven preference in 15%, non-inflammatory pain in 9%, and a variety of other less common reasons for non-intensification of therapy (5).

In this report, we present a rationale concerning a need for an initiative not only to show data, but also to ask for a clinical decision to be taken and possible reasons not to implement treatment recommendations. The goal of this new DANBIO initiative is to interactively improve disease control in patients with RA. We aimed to calculate how many patients with RA in DANBIO who met criteria for activation of the interactive alert-prompt (clinical signs of inflammatory activity, *i.e.* one or more swollen joints and moderate/high disease activity as judged by CDAI or DAS28CRP), to further investigate the rationale to establish this initiative. We also planned to study whether the subgroup of patients with persistent high or moderate activity differs from the patients with low activity or remission.

Finally, we also aimed to study in a pilot test how the physicians replied to the alternatives in the pop-up.

Materials and methods

The DANBIO registry is a data repository that is legally regulated to be used both as part of the patient medical record and to monitor quality of treatment. DANBIO serves as a tool to assist physicians in clinical decision making in the individual patient with inflammatory arthritis (*e.g.* RA, axial spondyloarthritis (AxSpA) and psoriatic arthritis (PsA)). DANBIO serves as a quality registry aiming to improve quality of medical treatment and per-

form epidemiologic-type analyses concerning actual treatment of patients with inflammatory arthritic conditions (6-10).

Data are captured from several sources: Patient complete standardised, validated questionnaires on patient-dedicated touch screens in the waiting area routinely before the clinical visit. For patients with RA, these patient-reported measures include the patient acceptable symptom state (PASS), the health assessment questionnaire (HAQ), visual analogue scores (VAS) for pain, fatigue and global, quality of life (EQ-5D) and capture different aspects of the impact of the disease on the patient's

Pop-up message for alert:

This patient has at least one swollen joint AND either CDAI ≥ 10.1 or DAS 28CRP > 3.2 .

Which action do you as a physician take today:

- Intensify treatment;
- Treatment intensification is not possible currently/awaiting results of additional investigations;
- No further treatment intensification is possible;
- The patient does not want to intensify treatment;
- Other decisions taken.

Table I. Clinical characteristics of patients.

Criteria for alert message fulfilled	Yes		No	<i>p</i> -value for difference between a+b vs. c	
Activation of pop-up by physician	a Yes	b No	<i>p</i> -value for difference between a and b	c	
No of patients	5,428	2,973		12,655	
Age (years)	65 (54-72)	64 (53-72)	0.35	65 (55-73)	<0.0001
Disease duration (years)	7 (2-16)	6 (1-14)	<0.0001	8 (4-16)	<0.0001
HAQ (0-3)	1.125 (0-1.625)	1 (0.625-1.625)	<0.0001	0.375 (0-1)	
VAS for pain (0-100)	58 (38-74)	52 (34-71)	<0.0001	20 (8-39)	<0.0001
VAS for fatigue (0-100)	63 (40-78)	58 (35-76)	<0.0001	30 (11-55)	<0.0001
VAS for global (0-100)	65 (45-80)	62 (41-79)	<0.0001	23 (8-47)	<0.0001
TJC (0-28)	4 (2-8)	4 (2-8)	-	0 (0-1)	<0.0001
SJC (0-28)	3 (1-5)	3 (1-5)	-	0 (0-0)	<0.0001
C-reactive protein (mg/L)	9 (3-19)	8 (3-18)	0.05	3 (2-7)	<0.0001
Receiving biologics currently (%)	23.8	21.9	0.06	21.6	0.001

Shown are medians (inter-quartile ranges), unless otherwise indicated. Mann-Whitney and Chi-square tests.

Table II. Physicians' responses to pop-up questions.

Treatment intensified	67%
Treatment intensification not possible currently /awaiting results of additional investigations	13%
No further treatment intensification is possible	2%
The patient does not want to intensify treatment	8%
Other decisions	10%

everyday life. Together they are imported by the physician into the DANBIO registry and provide the physician with important information. Thus, the PASS reflects whether the patient finds his or her present disease state to be acceptable or not, allowing the physician to consider which actions that may be relevant for this specific patient at this specific visit – even before the patient has entered the room.

Other information is also easier to collect at the source, *i.e.* by having the patient enter information via the touch screen annually regarding *e.g.* lifestyle (tobacco, alcohol, exercise), comorbidities, BMI, marital status and educational level.

During the visit, the physician enters relevant observations regarding the patient, *e.g.* swollen (SJC) and tender (TJC) joint counts, and doctor's global, medication (drug type, dose and frequency, start and stop date) and adverse reactions to treatment, C-reactive protein (CRP) and radiographic status.

When a patient with RA presents with

one or more swollen joints AND moderate/high disease activity (*i.e.* either $CDAI \geq 10.1$ and/or $DAS28CRP > 3.2$), a red alert is shown (top blue arrow in Fig. 1), which activates a pop-up that asks the doctor to check one of five checkboxes as an indication of the doctor's reaction to the unsatisfactory disease control (see inserted box for details).

"Treatment intensification" is interpreted broadly: Some patients are switched to other disease-modifying drugs (DMARDs - biologic or non biologic), in others, the dose of DMARD is increased and/or additional glucocorticoid treatment (often given intrarticularly) (11) is given.

The choice "Treatment intensification is not possible currently/awaiting results of additional investigations" is used for example in pregnant women or patients with previous malignancies who cannot switch to a biological DMARD, or patients awaiting radiographic status to see if the inflammation has led to radiographic progression.

"No further treatment intensification is possible" refers to patients who are insufficient responders or intolerant to all available DMARDs options.

In some cases, the shared decision-making at the visit reveals that "The patient does not want to intensify treatment". This may be the case in patients who have one or several chronically swollen joints that do not bother the patient, or in patients who are satisfied with the current treatment and do not want any change.

The "other" option is ticked for miscellaneous reasons.

Results

During the initial testing period (between October 2014 and July 2016) of the interactive feature, a total of 21,056 patients with RA were registered with a visit in DANBIO. Of these, 12,655 (60%) had low scores including remission on various measures of disease activity, and no alert was elicited. However, 8,401 patients (40%) fulfilled the criteria for showing the alert-message (Table I). In 5,428 of these patients (65%), the pop-up was activated and completed by the physician. The patients who had the pop-up activated had largely similar disease characteristics as those who did not with no important clinically relevant differences (Table I, a vs. b). Table II shows the results of the interactive pop-up in the 5,428 patients.

Discussion

Electronic capture of data has become widely available and clinical databases may be established at only moderate costs. Electronic systems enable automatic calculation of DAS28 and CDAI, thus facilitating feasibility in routine care by saving time for the doctors.

We studied the need for additional tools for the clinicians who see RA patients in routine care and use the DANBIO registry for monitoring of their patients. The current initiative was taken in an attempt to improve outcome for the sub-group of patients with RA who present at the clinic with clinical signs of inflammatory activity, *i.e.* one or more swollen joints and moderate/high disease activity as judged by CDAI or

DAS28CRP (12). CDAI was included because in routine care, CRP is often not present until after the patient has left the clinic. Since the effort was to be implemented in a very busy, clinical setting, it was decided to keep the number of alternative answers at a minimum, *i.e.* 5 replies.

The first results of the DANBIO initiative, presented in this report, indicated that although the majority (60%) of patients had well-controlled disease, a substantial minority of patients presented with objective signs of active disease (*i.e.* at least one swollen joint and moderate or high DAS28 or CDAI). According to the selection criteria, the latter differed from those with well-controlled disease in most aspects of the disease.

For this patient group, an interactive feature was developed aiming at prompting the physician to consider treatment intensification, simply by checking one of five boxes. The real-life introduction of the feature showed that in 65% of alerts, the physician activated the interactive pop-up, which is satisfactory, as no education or instructions were given prior to the implementation.

The physicians activated the pop-up feature in a representative sample of more than 5,000 patients during the test period. In two-thirds of the cases, the physicians chose to intensify treat-

ment, which reflects that the pop-up stimulates clinicians to consider improved adherence to current treatment guidelines. Physicians reported that no additional treatment intensification was possible in 2% of the patients, and that 8% of the patients objected to treatment intensification.

Future initiatives include education of the physicians to improve the adherence to activation of the pop-up in patients with the red alert. Furthermore, it will be interesting to study, how treatment is intensified and whether the initiative leads to better inflammatory control (*i.e.* more patients treated to-target and better short- and long-term outcomes).

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