ONLINE SUPPLEMENTARY DATA

Supplementary Table 1. Baseline characteristics of included and excluded subjects

Characteristic	Subjects included in binary and Cox analyses (n=916)	Subjects included only in Cox regression (n=158)	Subjects excluded (n=423)
Female sex (n=1458)	593 (66%)	90 (58%)	256 (62%)
Age at diagnosis (years)	8.2 (2.9, 11.9)	10.8 (5.9, 14.1)	9.7 (4.0, 12.9)
Time from onset to diagnosis (months)	4.3 (2.2, 9.0)	4.9 (1.9, 11.9)	3.7 (1.7, 8.4)
Time from diagnosis to enrolment (months)	0.05 (0, 1.3)	0 (0, 1.0)	5.1 (3.3, 7.7)
JIA category (n=1492)			
Oligoarthritis	365 (40%)	69 (44%)	163 (39%)
RF- polyarthritis	194 (21%)	26 (16%)	66 (16%)
Enthesitis-related	118 (13%)	25 (16%)	73 (17%)
Systemic	58 (6.3%)	7 (4.4%)	25 (6.0%)
Psoriatic	48 (5.2%)	17 (11%)	29 (7.0%)
RF+ polyarthritis	40 (4.4%)	2 (1.3%)	18 (4.3%)
Undifferentiated	93 (10%)	12 (7.6%)	44 (11%)
Physician global assessment of disease activity	2.9 (1.4, 5.1)	2.6 (1, 4.8)	1.3 (0.3, 3.7)
Active joint count	2 (1, 7)	2 (1, 4)	1 (0, 4)

Numbers are median (25^{th}, 75^{th} centiles) unless otherwise specified. Subjects included in binary and Cox analyses fulfilled three criteria: 1) They were recruited within 90 days of diagnosis, 2) They received no biologic agents or triple DMARD therapy in the six months after diagnosis, 3) Our primary outcome was known (attainment of clinical remission on medication within a year of diagnosis). Most subjects included only in Cox regression missed the 12-month visit. Most excluded subjects were recruited >90 days after diagnosis or only provided data at the enrolment visit.

Details of the data cleaning and multiple imputation method:

Initial data cleaning for impossible values was performed. Continuous responses (time to remission on medication and time to inactive disease) were checked to ensure they were no longer than the total time since diagnosis. For many of the clinical variables there are strict bounds (e.g. on the questionnaire it asks for a value from 0-10); recorded values that were outside these bounds were coded as missing unless we were able to ascertain otherwise from the original patient questionnaire.

This was followed by a series of checks for extreme values. Patients were flagged and reviewed if they had extreme values of Pain, Active Joint Count, Parent Global Assessment, Quality of My Life (QoML), ESR, and CRP. Additionally we were concerned that the QoML question was confusing to patients, as it uses the scale of 0 (poor health) to 10 (excellent health), whereas most other questionnaires use 0 to indicate best and 10 to indicate worst. We checked that for each patient the value of QoML should point in the opposite direction (e.g. higher or lower than average) as the patient's estimate of Pain and Active Joint Count: discordance was flagged and reviewed.

As a result of the data cleaning, flagging, and reviewing, we coded 11 values as missing and 1 value was changed from 20.25 to 2.025.

All missing values were imputed on the 1074 patients. We used multiple imputation, which was performed using the approach of multivariate imputation by chained equations (*mice*) in R [1]. We used the default settings with a couple tweaks: firstly, we did not allow the sub-domains of CHAQ or JAQQ to be used to impute values of other variables, only the total scores were considered. Secondly, the pain intensity value from the CHAQ (How much pain do you think your child has had because of his or her illness in the past week?), was used as the predictor to impute values for the pain intensity value from the JAQQ (Mark an X on the line at a point corresponding to your degree of pain overall in the past week) and vice-versa. Finally, we followed Bodner's [2] recommendation to impute more often when the amount of missing data is higher: since our data had an overall 11% missing rate [11,230 of 98,012 possible entries were missing] we used 20 imputed datasets.

1. van Buuren S, Groothuis-Oudshoorn K. Multivariate Imputation by Chained Equations in R. J Stat Softw 2011;45(3):1-67.

2. Bodner TE. What improves with increased data imputations? Struct Equ Modeling 2008; 15(4).

Supplementary Table 2. Associations with early remission and disposition of all 87 candidate predictors considered in the study

Variable	*Odds ratio for early remission on medication*	*p-value*	*Entered Models (Binary, Cox)*	*Availability in routine care*	*Best binary model **	*Best Cox-logistic model*	*Notes***
DEMOGRAPHICS							
Sex	1.25 (0.88 - 1.76)	0.202	X	Easy			Clinically important to enter modeling despite a p>0.2
Age at JIA onset	0.97 (0.94 - 1.01)	0.097	X	Easy			
Weeks from onset to diagnosis	1.00 (0.99 - 1.00)	0.016	X	Easy		X	
Weeks from diagnosis to enrollment	1.07 (0.89 - 1.29)	0.453					
Parent Education	1.05 (0.89 - 1.25)	0.537					
Ethnicity:							As some ethnicities were associated with remission, all common ethnicities entered modeling
British	0.75 (0.53 - 1.04)	0.078	X	Hard			
French	1.37 (0.94 - 2.00)	0.091	X	Hard		X	
Eastern European	1.19 (0.77 - 1.86)	0.421	X	Hard			
Western European	0.89 (0.58 - 1.38)	0.606	X	Hard			
Southern European	1.14 (0.64 - 2.04)	0.65	X	Hard			
Indian subcontinent	1.00 (0.56 - 1.78)	0.994	X	Hard			
JIA CATEGORY		0.000001	X	Easy		X	
Oligoarthritis	1.22 (0.97-1.54)						
RF- polyarthritis	0.55 (0.39-0.79)						
Enthesitis related	0.67 (0.43-0.99)						
Systemic	1.04 (0.58-1.88)						
Psoriatic	1.29 (0.68-2.46)						
RF+ polyarthritis	0.24 (0.10-0.59)						
Undifferentiated	0.49 (0.30-0.81)						
FAMILY HISTORY							
Lupus	1.40 (0.64 - 3.05)	0.391					
Psoriatic Arthritis	1.54 (0.55 - 4.33)	0.407					
Rheumatoid Arthritis	0.84 (0.55 - 1.29)	0.412					
JRA or JIA	0.86 (0.48 - 1.55)	0.609					
Psoriasis	0.93 (0.71 - 1.23)	0.609					
IBD with Sacroiliitis	0.88 (0.47 - 1.67)	0.693					

Variable	*Odds ratio for early remission on medication*	*p-value*	*Entered Models (Binary, Cox)*	*Availability in routine care*	*Best binary model **	*Best Cox-logistic model*	*Notes***
IBD	1.06 (0.64 - 1.76)	0.822					
Uveitis	0.92 (0.26 - 3.34)	0.903					
Ankylosing Spondylitis	0.97 (0.41 - 2.33)	0.953					
PATTERN OF JOINT INVOLVEMENT							
Symmetric joint involvement	0.48 (0.34 - 0.66)	0.000005	X	Easy		X	All pattern of joint involvement variables entered modeling
Cervical spine involvement	0.45 (0.19 - 1.11)	0.076	X	Easy			
Temporal mandibular Joint Involvement	0.55 (0.32 - 0.94)	0.024	X	Easy			
Upper limb Involvement	0.51 (0.37 - 0.71)	0.000033	X	Easy		X	
Wrist involvement	0.59 (0.41 - 0.84)	0.003	X	Easy		X	
Finger Joint involvement	0.45 (0.32 - 0.64)	0.000004	X	Easy	X		
Sacroiliac Joint Involvement	0.89 (0.39 - 2.03)	0.774	X	Easy			
Lower limb Involvement	0.90 (0.61 - 1.34)	0.602	X	Easy		X	
Hip involvement	0.62 (0.37 - 1.05)	0.068	X	Easy			
Ankle involvement	0.73 (0.53 - 1.02)	0.063	X	Easy			
Subtalar joint involvement	0.56 (0.33 - 0.96)	0.032	X	Easy		X	
Presence of enthesitis	0.64 (0.37 - 1.09)	0.094	X	Easy		X	
No. enthesitis sites	0.94 (0.87 - 1.01)	0.104	X	Medium		X	
PHYSICIAN REPORT							
Physician global assessment of disease activity	0.84 (0.79 - 0.91)	0.000001	X	Easy	X	X	
Active joint count	0.96 (0.94 - 0.98)	0.000199	X	Easy	X		
Stiffness presence according to physician	0.76 (0.53 - 1.10)	0.136	X	Easy			
Stiffness duration according to physician	0.82 (0.55 - 1.22)	0.311	X	Easy			Entered modeling along with presence of stiffness
Uveitis	0.70 (0.26 - 1.89)	0.476					
Psoriasis	0.91 (0.42 - 1.99)	0.817					

Variable	*Odds ratio for early remission on medication*	*p-value*	*Entered Models (Binary, Cox)*	*Availability in routine care*	*Best binary model **	*Best Cox-logistic model*	*Notes***
JIA Rash	1.04 (0.52 - 2.06)	0.912					
PATIENT/PARENT REPORT							
Total JAQQ score	0.75 (0.66 - 0.85)	0.000005	X	Hard			
CHAQ disability index	0.60 (0.46 - 0.79)	0.000139	X	Medium			
Pain intensity in last week (CHAQ)	0.87 (0.82 - 0.93)	0.000007	X	Medium		X	
Pain intensity in last week (JAQQ)	0.88 (0.82 - 0.93)	0.000041					Included only pain intensity (CHAQ)
Quality of My Life score	1.11 (1.04 - 1.18)	0.002	X	Medium			
Parent Global Assessment of wellbeing	0.91 (0.85 - 0.97)	0.002	X	Medium		X	
JAQQ gross motor domain	0.84 (0.77 - 0.92)	0.000077					Included only the total JAQQ score
JAQQ fine motor domain	0.82 (0.74 - 0.91)	0.000235					
JAQQ psychological domain	0.80 (0.71 - 0.90)	0.000268					
JAQQ symptoms domain	0.86 (0.77 - 0.96)	0.005					
CHAQ reaching domain	0.68 (0.55 - 0.84)	0.000307					Included only the total CHAQ disability index
CHAQ activities domain	0.72 (0.60 - 0.87)	0.000393					
CHAQ hygiene domain	0.73 (0.59 - 0.91)	0.004					
CHAQ eating domain	0.71 (0.55 - 0.91)	0.005					
CHAQ gripping domain	0.77 (0.64 - 0.94)	0.007					
CHAQ arising domain	0.76 (0.61 - 0.93)	0.008					
CHAQ walking domain	0.79 (0.65 - 0.96)	0.015					
CHAQ dressing domain	0.81 (0.68 - 0.97)	0.022					
CHAQ item - help with reaching	0.42 (0.19 - 0.91)	0.025					
CHAQ item - walk	0.65 (0.40 - 1.07)	0.084					
CHAQ item - play	0.78 (0.63 - 0.95)	0.014					

Variable	*Odds ratio for early remission on medication*	*p-value*	*Entered Models (Binary, Cox)*	*Availability in routine care*	*Best binary model **	*Best Cox-logistic model*	*Notes***
Presence of morning stiffness	0.65 (0.45 - 0.94)	0.018					Physician assessment of stiffness used instead
Duration of Morning Stiffness	1.00 (1.00 - 1.00)	0.516					
Joint swelling reported by parents	1.25 (0.77 - 2.03)	0.357	X	Hard		X	Clinically important to enter modeling despite a p>0.2
Lower back pain	0.78 (0.43 - 1.42)	0.405					
Pain from swollen joints (yes/no)	0.82 (0.47 - 1.41)	0.459					
History of fever (yes/no)	1.21 (0.74 - 1.98)	0.444	X	Hard			Clinically important to enter modeling despite a p>0.2
Fever pattern	1.15 (0.58 - 2.28)	0.683					
History of limp	1.10 (0.79 - 1.53)	0.579					
LABORATORY							
RF positive at least once	0.31 (0.14 - 0.68)	0.003	X	Easy		X	
Level of C-reactive protein	0.99 (0.99 - 1.00)	0.01	X	Easy			
Erythrocyte sedimentation rate	1.00 (0.99 - 1.00)	0.342	X	Easy			Clinically important to enter modeling despite a p>0.2
B27 positive	1.15 (0.53 - 2.49)	0.722	X	Easy		X	
ANA positive	0.97 (0.58 - 1.60)	0.89	X	Easy		X	
INITIAL TREATMENT							
DMARD	0.65 (0.45 - 0.95)	0.022	X	Medium			All systemic drug use entered modeling
Systemic corticosteroids	0.61 (0.37 - 1.01)	0.048	X	Medium			
Joint injection	0.90 (0.61 - 1.31)	0.559					
NSAID	1.11 (0.57 - 2.17)	0.756	X	Medium			

* Our best binary model was a random forest. Random forest models use all the variables provided, they do not drop variables because of a p value cut-off. To understand which variables in the Random Forest are most important for the model's performance, we used the permutation importance methodology of Altmann et al [1] and the p-value calculations of Phipson and Smyth [2]. This is implemented in the *R* package *pRF* [3]. For our purposes, variables with a p-value < 0.05 were marked as retained.

** The decision to enter a variable in modeling was taken by consensus of the investigators based on statistical and clinical considerations. All variables with univariable association strength of $p < 0.2$ were entered, unless they correlated closely with other variable and had conceptual overlap (e.g. only one measure of pain entered modeling and only total scores, no subdomains, of CHAQ and JAQQ entered modeling). Several variables with a $p > 0.2$ entered modeling because they had strong

support from previous research as important predictors of JIA prognosis and most clinicians would like to ensure they were considered in modeling. For every such variable, the notes section has a brief comment on the reason. JAQQ and CHAQ domains and isolated CHAQ items were initially considered in case one of them was significantly more predictive of remission than the total questionnaire scores; since this was not the case and they were highly correlated to the total scores, only the total scores entered modeling. The pain scale and the parent global assessment from the CHAQ do not form part of the CHAQ Disability Index; they were considered separate predictors.

1. Altmann A, Tolosi L, Sander O, Lengauer T. Permutation importance: a corrected feature importance measure. Bioinformatics 2010;26:1340-7

2. Phipson B, Smyth GK. Permutation P-values should never be zero: calculating exact P-values when permutations are randomly drawn. Stat Appl Genet Mol Biol 2010;9:39.

3. Ankur Chakravarthy (2016). pRF: Permutation Significance for Random Forests. R package version 1.2. https://CRAN.R-project.org/package=pRF

Supplementary Tables S3, S4, S5: Results of subgroup sensitivity analyses

Since JIA is a heterogeneous disease, we assessed whether a model fit to a more homogeneous set of patients could do a better job of predicting remission in those patients. In essence, we repeated the Cox-Logistic modeling using three specific clinical groups as the new population:

1) A cohort consisting only of patients with Oligoarthritis or RF- polyarthritis

2) A cohort presenting with fewer or equal to 4 active joints, excluding sacroiliitis and systemic JIA

3) A cohort presenting with 5 or more active joints, excluding sacroiliitis and systemic JIA

The analysis was re-run with each of these 3 cohorts as the entire population for modelling with JIA Category removed as a potential predictor of remission. Each analysis involves 10 runs of all 20 imputed datasets. As before, we hold out about 25% of the data for testing only (see below). We compute the C-Index along with its 95% CI, and provide tables of the adjusted hazard ratios from the Cox-Logistic Models. Our conclusion is that fitting a model specifically for these patients does not result on improved prediction of remission for those patients, relative to our primary model. As such, we are content to use a single model to predict remission for all patients.

Cohort	**Number of subjects**	**Subjects with known early remission status**	**Subjects held out in the test set**	**C-Index on test data (95% CI)**
1)	654	559	140	0.657 (0.622 - 0.691)
2)	598	499	125	0.645 (0.612 - 0.678)
3)	368	325	81	0.679 (0.633 - 0.726)

Supplementary Table 3 (Sensitivity analysis 1): Baseline variables retained in the best Cox-logistic model using only data from patients with oligoarthritis and polyarthritis RF-negative (C-index= 0.66, CI 0.62-0.69)

Variable	Adjusted hazard ration for time to remission on medications (95%CI)	P-value	Adjusted hazard ration for time to inactive disease (95%CI)	P-value
Pain intensity in last week	0.888 (0.819-0.964)	0.004	0.891 (0.832-0.954)	0.001
Physician global assessment of disease activity	0.909 (0.847-0.974)	0.006	--	
Upper limb involvement	--		0.495 (0.286-0.858)	0.011
Lower limb involvement	--		0.561 (0.399-0.790)	0.001
CRP level in mg/L	--		0.993 (0.986-0.999)	0.026
ANA positive	0.784 (0.613-1.004)	0.049	--	
Quality of my life score	1.062 (0.999-1.128)	0.047	--	
Joint swelling reported by parents	--		1.434 (1.046-1.966)	0.022

Supplementary Table 4 (Sensitivity analysis 2): Baseline variables retained in the best Cox-logistic model using only data from patients with <5 joints affected at enrolment, after excluding patients with sacroiliitis and systemic JIA (C-index= 0.64, CI 0.61-0.68)

Variable	Adjusted hazard ration for time to remission on medications (95%CI)	P-value	Adjusted hazard ration for time to inactive disease (95%CI)	P-value
Pain intensity in last week	0.871 (0.803-0.943)	0.001	0.915 (0.859-0.975)	0.005
Physician global assessment of disease activity	0.901 (0.844-0.962)	0.001	0.924 (0.917-0.994)	0.003
Weeks from onset to diagnosis	0.997 (0.994-0.999)	0.002	0.997 (0.995-0.998)	<0.001
Upper limb involvement	--		0.663 (0.459-0.958)	0.025
Lower limb involvement	--		0.674 (0.509-0.893)	0.005
No. enthesitis sites	0.918 (0.0843-1.0)	0.045	--	
Parent global assessment of wellbeing	--		1.091 (1.033-1.152)	0.001
CRP level in mg/L	--		0.993 (0.987-0.999)	0.024
Any French ethnicity	1.292 (1.022-1.633)	0.029	--	

Supplementary Table 5 (Sensitivity analysis 3): Baseline variables retained in the best Cox-logistic model using only data from patients with >4 joints affected at enrolment, after excluding patients with sacroiliitis and systemic JIA (C-index= 0.68, CI 0.63-0.73)

Variable	Adjusted hazard ration for time to remission on medications (95%CI)	P-value	Adjusted hazard ration for time to inactive disease (95%CI)	P-value
RF positive at least once	0.203 (0.095-0.433	<0.001	0.438 (0.274-0.700)	<0.001
No. enthesitis sites	0.860 (0.773-0.956)	0.004	0.912 (0.841-0.989)	0.022
Physician global assessment of disease activity	0.907 (0.823-1.000)	0.045	--	
Weeks from onset to diagnosis	0.996 (0.992-0.999)	0.011	0.997 (0.995-0.999)	0.006
Wrist involvement	1.761 (1.091-2.844)	0.018	1.641 (1.145-2.352)	0.006
Stiffness duration according to Physician	1.756 (1.069-2.883)	0.023	1.558 (1.087-2.232)	0.014
Stiffness presence according to Physician	2.043 (1.153-3.620)	0.012	--	
CHAQ disability index	0.605 (0.380-0.963)	0.031	--	
ANA positive	0.633 (0.429-0.933)	0.018	--	
Any French ethnicity	2.013 (1.329-3.050)	0.001	1.369 (1.006-1.863)	0.042