Table S1 Case-control cohorts studied. AS=ankylosing spondylitis. Gender is as imputed from SNP array data.

Type	Cohort	Males	Females	Number of samples	Version of CoreExome chip
AS	United Kingdom AS Cohort [1]	4568	1928	6499*	24v1-0, 24v1-1
AS	Australo-Anglo-American Spondyloarthritis Consortium (TASC) [2]	751	377	1128*	24v1-1
AS	Australian AS Cohort [3]	333	92	425*	24v1-0, 24v1-1
AS	Groupe Française d'Etude Génétique des Spondylarthrites (GFEGS) [3]	123	69	192*	
AS	Chinese AS cohort [3]	4786	1215	6001◦	24v1-1
AS	Turkish AS cases [4]	668	239	910	24v1-0
AS	Iranian AS cases [4]	336	92	430	24v1-0
Controls	The UK Household Longitudinal Study [1]	4178	5283	9469*	12v1
Controls	Queensland Institute of Medical Research Berghofer Medical Research Institute Twins Cohort [2]	1006	1655	2664*	12v1
Controls	Advancing Exercise & Sports Science Collaborative Research	765	734	1504*	24v1-1

	Network [3]				
Controls	Oregon Metagenomics Controls [5]	38	44	82*	24v1-1
Controls	Australian general population healthy controls [3]	291	264	555*	24v1-0, 24v1-1
Controls	Chinese general population controls [3]	3159	1784	4943◦	24v1-0
Controls	Turkish general population controls [4]	661	258	924	24v1-0
Controls	Iranian general population controls [4]	590	164	761	24v1-0, 24v1-1

* Included in European-descent cohort.

◦ Included in East Asian cohort

Please note that as for some sample's imputation did not assign gender definitively, the total sample number may differ from the sum of the numbers of males and females.

1. The UK AS Cohort was recruited from patients attending hospital-based rheumatology services across the United Kingdom. Rheumatology specialists caring for the patients confirmed the diagnosis of AS according to the modified New York Criteria for AS. Pelvic radiographs were reported by local expert readers.
2. Australo-Anglo-American Spondyloarthritis Consortium cohort was recruited from patients attending hospital-based rheumatology services in Australia and the United States. Rheumatology specialists caring for the patients confirmed the diagnosis of AS according to the modified New York Criteria for AS. Pelvic radiographs were centrally reported by expert readers.

3. The Australian AS cohort was recruited from patients attending rheumatology services (both hospital based and from community rheumatology practices) in Australia. Rheumatology specialists caring for the patients confirmed the diagnosis of AS according to the modified New York Criteria for AS. Pelvic radiographs were centrally reported by expert readers.
4. The Groupe Française d'Etude Génétique des Spondylarthrites (GFEGS) was recruited from hospital-based rheumatology services in France. Rheumatology specialists caring for the patients confirmed the diagnosis of AS according to the modified New York Criteria for AS. Pelvic radiographs were reported by local expert readers.
5. The Chinese AS Cohort was recruited from self-reporting Han Chinese ethnicity patients attending hospital-based rheumatology services in China and Taiwan. Rheumatology specialists caring for the patients confirmed the diagnosis of AS according to the modified New York Criteria for AS. Pelvic radiographs were reported by local expert readers.
6. The Turkish and Iranian AS Cohorts were recruited from patients attending hospital-based rheumatology services in Turkey and Iran respectively. Rheumatology specialists caring for the patients confirmed the diagnosis of AS according to the modified New York Criteria for AS. Pelvic radiographs were reported by local expert readers.

Supplementary Method

Genotyping Chips and Quality Control

The cohorts were all typed on Illumina Core-Exome chip. The chip versions used are 24v1-1, 24v1-0, 12v1 and 12v1. The number of overlapping SNPs among these chips is greater than 95%. All the data were called separately based on the Core-Exome chip versions from GenomeStudio 2.0. Ethnicity-specific data was strand fixed based on the chip version. The ethnicity-specific datasets were then merged into a European-descent cohort and an East Asian cohort using the common SNPs between datasets. Then normal GWAS quality control was applied to all the cohorts in this study. Related samples (PI_HAT >0.185) were excluded. Samples were further excluded if their missingness rate

was >5%, or heterozygosity > 3 standard deviations from mean, or were outliers in the principal component analysis (by SHELLFISH). Variants were excluded if their missingness rate was >2%, or Hardy-Weinberg equilibrium test P-value < $1x10^{-6}$, or they have significant different missingness rate in cases vs controls (P <$1x10^{-7}$).

Confidence interval of AUC

The confidence interval of AUC was calculated by R package pROC.

Table S2 Performance of HLA-B27 and AS PRS with controlling PCA and sex.

	Population tested in			
Predictors	European	East Asian	Iranian	Turkish
HLA-B27	0.869 (0.865-0.874)	0.901 (0.895-0.906)	0.831 (0.807-0.854)	0.821 (0.804-0.838)
European non-MHC PRS (PCA+SEX)	0.776 (0.770-0.782)	0.54 (0.534-0.556)	0.54 (0.500-0.569)	0.58 (0.553-0.605)
European overall PRS (PCA+SEX)	0.923 (0.919-0.927)	0.761 (0.752-0.770)	0.853 (0.827-0.880)	0.849 (0.830-0.867)
East Asian non-MHC PRS (PCA+SEX)	0.59 (0.578-0.593)	0.639 (0.629-0.650)	0.59 (0.553-0.620)	0.61 (0.581-0.633)
East Asian overall PRS(PCA+SEX)	0.88 (0.879-0.889)	0.942 (0.937-0.947)	0.87 (0.850-0.896)	0.84 (0.820-0.859)
PCA alone – European	0.630	-	-	-
PCA alone – East Asian	-	0.750	-	-
PCA alone – Iranian	-	-	0.536	
PCA alone – Turkish	-	-	-	0.520

Supplementary References

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