

Appendix A

Characteristic	N	Not re-referred N = 27,777 ¹	Re-referred N = 3,095 ¹
Age (years)	30,872	55 (16)	55 (16)
Sex (female)	30,872	15,484 (56%)	1,757 (57%)
BMI	30,872		
Healthy weight range		8,311 (30%)	807 (26%)
Underweight		293 (1.1%)	36 (1.2%)
Overweight		9,468 (34%)	1,010 (33%)
Obese		6,220 (22%)	697 (23%)
Severely obese		740 (2.7%)	68 (2.2%)
Not answered		2,745 (9.9%)	477 (15%)
Diagnosis type	30,872		
Low back pain		20,924 (75%)	2,408 (78%)
Neck and mid-back pain		6,853 (25%)	687 (22%)
MR referral	30,872	9,360 (34%)	1,381 (45%)
Rehabilitation plan given	27,111	2,290 (9.3%)	264 (10%)
Alcohol	30,872		
None		10,538 (38%)	1,145 (37%)
1 to 7		10,532 (38%)	1,072 (35%)
8 to 14		2,424 (8.7%)	244 (7.9%)
15+		651 (2.3%)	64 (2.1%)
Not answered		3,632 (13%)	570 (18%)
Cigarettes	30,872		
Non-smoker		18,247 (66%)	1,872 (60%)
Smoker		5,833 (21%)	657 (21%)
Not answered		3,697 (13%)	566 (18%)
Previous spine surgery	30,872	3,692 (13%)	508 (16%)
Pain	27,603	6.18 (2.36)	6.53 (2.20)
Pain extremity	26,601	5.0 (3.1)	5.6 (3.0)
Onset cause	30,872		
Unknown		12,726 (46%)	1,281 (41%)
Forward bend		1,720 (6.2%)	179 (5.8%)
Lifting activity		2,238 (8.1%)	231 (7.5%)
Sudden unexpected movement		2,096 (7.5%)	235 (7.6%)
Other		6,182 (22%)	694 (22%)
Not answered		2,815 (10%)	475 (15%)
Physical trauma	30,872		
No		19,644 (71%)	2,044 (66%)
Yes		5,091 (18%)	553 (18%)
Not answered		3,042 (11%)	498 (16%)
Slow improvement after pain flare-up	30,872		
No		5,065 (18%)	449 (15%)
Yes		19,314 (70%)	2,097 (68%)
Not answered		3,398 (12%)	549 (18%)
Pain onset type	30,871		
Slowly		14,766 (53%)	1,537 (50%)
Sudden		10,234 (37%)	1,091 (35%)

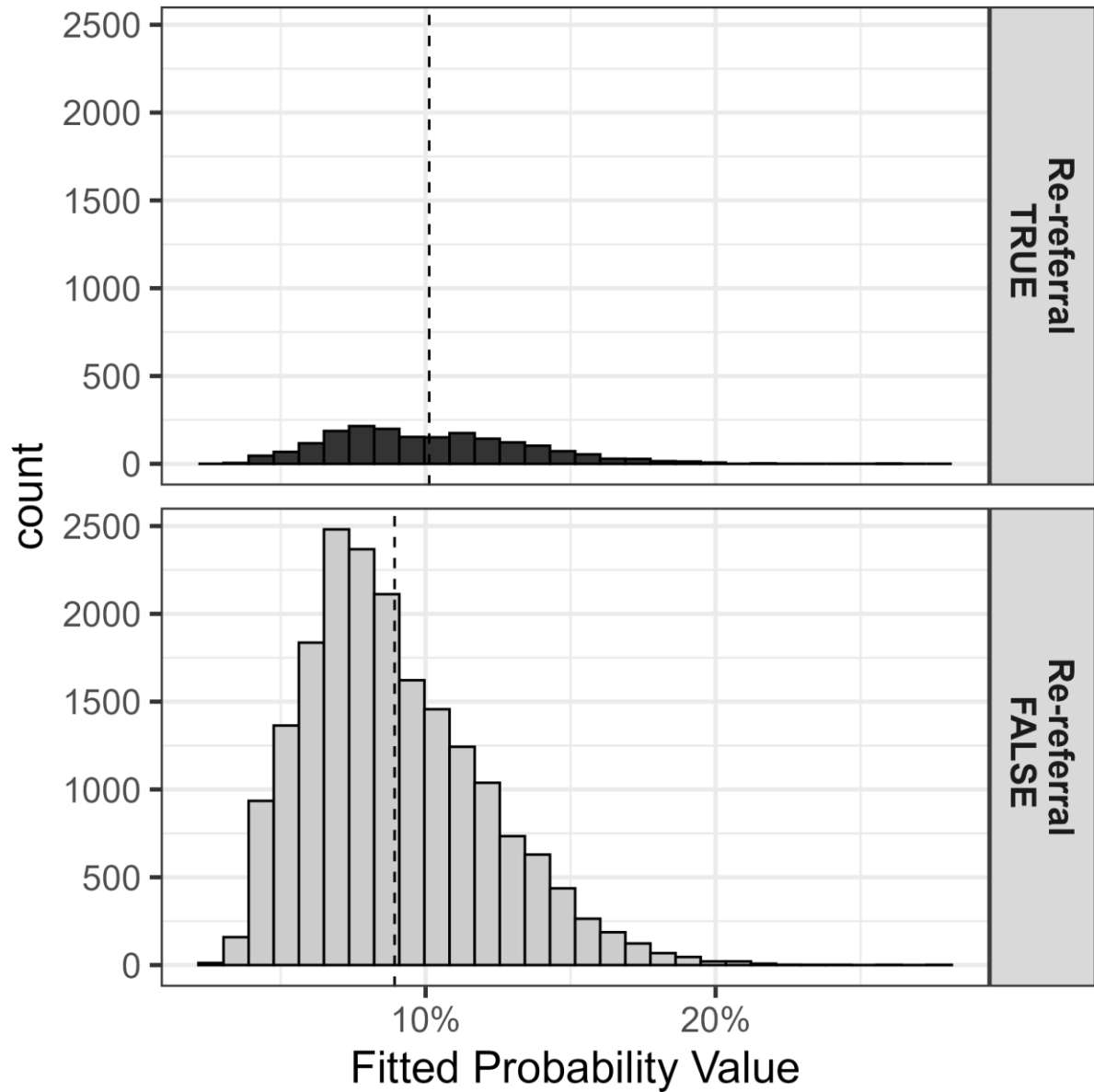
Not answered		2,777 (10.0%)	466 (15%)
Previous episodes	30,871		
No		5,630 (20%)	566 (18%)
Yes		19,294 (69%)	2,041 (66%)
Not answered		2,853 (10%)	487 (16%)
Status last 2 weeks	30,872		
Unchanged		15,801 (57%)	1,515 (49%)
Worsened		6,809 (25%)	908 (29%)
Improved		2,507 (9.0%)	214 (6.9%)
Not answered		2,660 (9.6%)	458 (15%)
Worst time of day	30,872		
No difference		10,162 (37%)	1,061 (34%)
Evening		1,110 (4.0%)	96 (3.1%)
Morning		2,639 (9.5%)	280 (9.0%)
Morning and evening		2,867 (10%)	303 (9.8%)
Night		1,581 (5.7%)	126 (4.1%)
Worsening during the day		6,520 (23%)	756 (24%)
Not answered		2,898 (10%)	473 (15%)
Bladder and bowel control problems	30,872	7,330 (26%)	845 (27%)
Aggravated by physical activity	30,872		
No		4,476 (16%)	393 (13%)
Yes		20,398 (73%)	2,211 (71%)
Not answered		2,903 (10%)	491 (16%)
Recreational activity level	26,126		
Sedentary		5,747 (24%)	622 (25%)
Moderate		13,008 (55%)	1,409 (57%)
Active		4,552 (19%)	413 (17%)
Vigorous		348 (1.5%)	27 (1.1%)
Changes in duties at work	30,872		
No		12,959 (47%)	1,213 (39%)
Yes		2,866 (10%)	352 (11%)
Not relevant		11,952 (43%)	1,530 (49%)
Ongoing insurance claim	30,872	1,449 (5.2%)	207 (6.7%)
Applied for pension	30,872		
No		11,400 (41%)	1,426 (46%)
Yes		825 (3.0%)	118 (3.8%)
Not relevant		15,552 (56%)	1,551 (50%)
Received pension	30,872		
No		11,135 (40%)	1,399 (45%)
Yes		1,067 (3.8%)	146 (4.7%)
Not relevant		15,575 (56%)	1,550 (50%)
Present work	30,872		
Ordinary		9,983 (36%)	926 (30%)
Student		815 (2.9%)	93 (3.0%)
Disability pension		1,730 (6.2%)	240 (7.8%)
Early retirement		302 (1.1%)	26 (0.8%)

Flexible job		1,345 (4.8%)	148 (4.8%)
Ordinary retirement		6,275 (23%)	699 (23%)
Homemaker		386 (1.4%)	35 (1.1%)
Unemployed		1,388 (5.0%)	162 (5.2%)
Vocational rehabilitation		319 (1.1%)	34 (1.1%)
Other		5,234 (19%)	732 (24%)
Reduced working hours	30,872		
No		13,622 (49%)	1,298 (42%)
Yes		2,237 (8.1%)	267 (8.6%)
Not relevant		11,918 (43%)	1,530 (49%)
Sick leave in last 3 month	30,872		
No		9,784 (35%)	840 (27%)
Yes		6,282 (23%)	737 (24%)
Not relevant		11,711 (42%)	1,518 (49%)
Anxiety	27,222	4.0 (3.2)	4.4 (3.2)
EQ5D VAS ²	26,613	53 (24)	50 (23)
Perceived risk of chronicity	27,050	6.85 (2.69)	7.02 (2.65)
Loneliness	27,089	1.62 (2.57)	1.89 (2.78)
Pain medication	30,872		
No		6,454 (23%)	485 (16%)
Yes		18,683 (67%)	2,125 (69%)
Not answered		2,640 (9.5%)	485 (16%)
Days since onset	30,872		
< 3 months		4,355 (16%)	483 (16%)
< 1 year		8,839 (32%)	1,019 (33%)
> 1 year		11,421 (41%)	1,086 (35%)
Not answered		3,162 (11%)	507 (16%)
Referral diagnosis of other	30,872	1,110 (4.0%)	127 (4.1%)
Referral diagnosis of radiculopathy	30,872	3,962 (14%)	480 (16%)
Referral diagnosis of stenosis	30,872	2,381 (8.6%)	343 (11%)
Referral diagnosis of spine-specific other	30,872	1,552 (5.6%)	158 (5.1%)
Referral diagnosis of spine non-specific	30,872	17,525 (63%)	1,714 (55%)
Referral diagnosis of non-spine-specific	30,872	1,078 (3.9%)	98 (3.2%)
Referral diagnosis of non-spine non-specific	30,872	839 (3.0%)	71 (2.3%)
Referral diagnosis of generalized pain	30,872	741 (2.7%)	56 (1.8%)
Disability ³	26,062	0.00 (1.04)	0.18 (1.00)
Weakness	30,872		
None		13,065 (47%)	1,362 (44%)
Region		11,069 (40%)	1,269 (41%)
Multi		2,921 (11%)	397 (13%)
Other		722 (2.6%)	67 (2.2%)
Catastrophizing	27,294	4.8 (3.0)	5.2 (3.0)
Depression	27,229	4.14 (3.10)	4.56 (3.10)
Fear of movement	26,907	4.5 (3.1)	4.6 (3.2)
Pins and needles	30,872		

None		8,268 (30%)	933 (30%)
Region		13,463 (48%)	1,420 (46%)
Multi		5,223 (19%)	657 (21%)
Other		823 (3.0%)	85 (2.7%)
Disease	30,872		
None		21,637 (78%)	2,382 (77%)
Lung		1,847 (6.6%)	183 (5.9%)
Heart		2,134 (7.7%)	218 (7.0%)
Unexpected weight loss		831 (3.0%)	108 (3.5%)
Multimorbid		1,328 (4.8%)	204 (6.6%)
Number of re-references	30,872		
0		27,777 (100%)	0 (0%)
1		0 (0%)	2,692 (87%)
2		0 (0%)	349 (11%)
3		0 (0%)	42 (1.4%)
4		0 (0%)	10 (0.3%)
5		0 (0%)	2 (<0.1%)
¹ Mean (SD); n (%) ² EuroQol ³ Disability score is Z-scaled (mean = 0, SD = 1)			

Appendix B

Distribution of predicted probabilities for re-referral status (Tjur's D visualization).



Alt text: Histograms of fitted probabilities from the final logistic regression model, stratified by actual re-referral status. The top panel shows predicted probabilities for re-referred patients, and the bottom panel shows those who were not. The dashed vertical lines represent the mean predicted probability in each group. The difference between these means corresponds to Tjur's coefficient of discrimination ($D = 0.017$), reflecting the model's limited ability to distinguish between re-referred and non-re-referred patients.