

RATE OF SECOND INJURIES AFTER ACL RECONSTRUCTION AND LATERAL TENODESIS WITH HAMSTRINGS IN 318 TEENAGER PATIENTS AT AN AVERAGE FOLLOW-UP OF 7 YEARS



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DISCLOSURE

NOTHING TO DISCLOSE



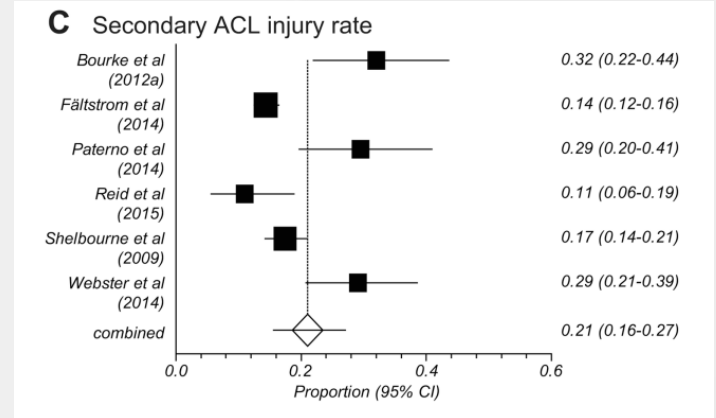
INTRODUCTION

HIGH RISK OF 2nd INJURY
(EITHER IPSILATERAL OR CONTRALATERAL)
AFTER ACL RECONSTRUCTION IN
YOUNG PATIENTS

WIGGINS AJSM 2016

FEW LONG-TERM STUDIES ON
TEENAGERS (13-19 YEARS)
UNKNOWN ROLE OF **AGE-RELATED**
RISK PROFILES

CORDASCO AJSM 2019



> Am J Sports Med. 2019 Mar;47(3):628-639. doi: 10.1177/0363546518819217. Epub 2019 Jan 15.

Return to Sport and Reoperation Rates in Patients Under the Age of 20 After Primary Anterior Cruciate Ligament Reconstruction: Risk Profile Comparing 3 Patient Groups Predicated Upon Skeletal Age

Frank A Cordasco ¹, Sheena R Black ², Meghan Price ³, Colleen Wixted ³, Michael Heller ¹, Lori Ann Asaro ¹, Joseph Nguyen ⁴, Daniel W Green ⁵

STUDY PURPOSE: TO INVESTIGATE THE RATE OF 2nd ACL INJURY (EITHER IPSILATERAL OR CONTRALATERAL) IN A LARGE SERIES OF TEENAGES OVER A PERIOD OF >10 YEARS STRATIFIED ACCORDING TO AGE RANGES

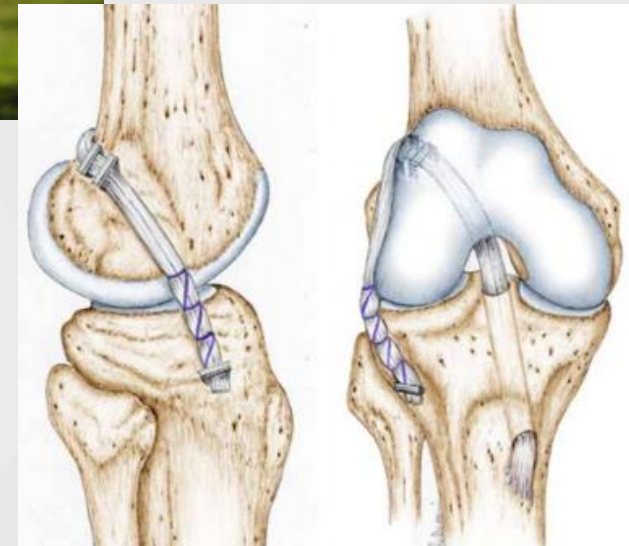


METHODS

RETROSPECTIVE EVALUATION FROM INTERNAL DATABASE:

INCLUSION CRITERIA:

- TEENAGER PATIENTS (13 – 19 YEARS)
- ACL RECONSTRUCTION WITH HAMSTRINGS
OVER-THE-TOP + LET (2 SURGEONS)
- OPERATIONS BETWEEN 2007 – 2019
- NO PREVIOUS SURGERY (BOTH KNEES)
- MINIMUM FOLLOW-UP OF 2 YARS



METHODS

RETROSPECTIVE EVALUATION FROM INTERNAL DATABASE:

PATIENT ASSESSMENT:

- MEDICAL CHARTS (DEMOGRAPHICS)

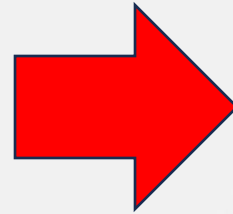
- PHONE INTERVIEW:

PRE-INJURY SPORT

REOPERATIONS

IPSILATERAL ACL REVISION

CONTRALATERAL ACL RECONSTRUCTION



ENDPOINTS FOR KAPLAN MEIER

AND MULTIVARIATE ANALYSIS:

- IPSILATERAL REVISION

- CONTRALATERAL REVISION

- 2nd INJURY (IPSI+CONTRA)

VARIABLES:

- AGE (**13-15** vs **15-17** vs **17-19** YEARS)

- SPORT (TEGNER ≥ 8 vs < 8)

- SEX and BMI (< 25 vs > 25)



RESULTS

318 OUT OF 382 ELEIGIBLE PATIENTS (18% DROPOUT)

16.3 ± 1.4 YEARS AVERAGE AGE

13-15 YEARS: 69 (22%)

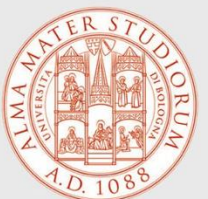
15-17 YEARS: 137 (43%)

17-19 YEARS: 112 (35%)

SEX: 73% MALES, 27% FEMALES

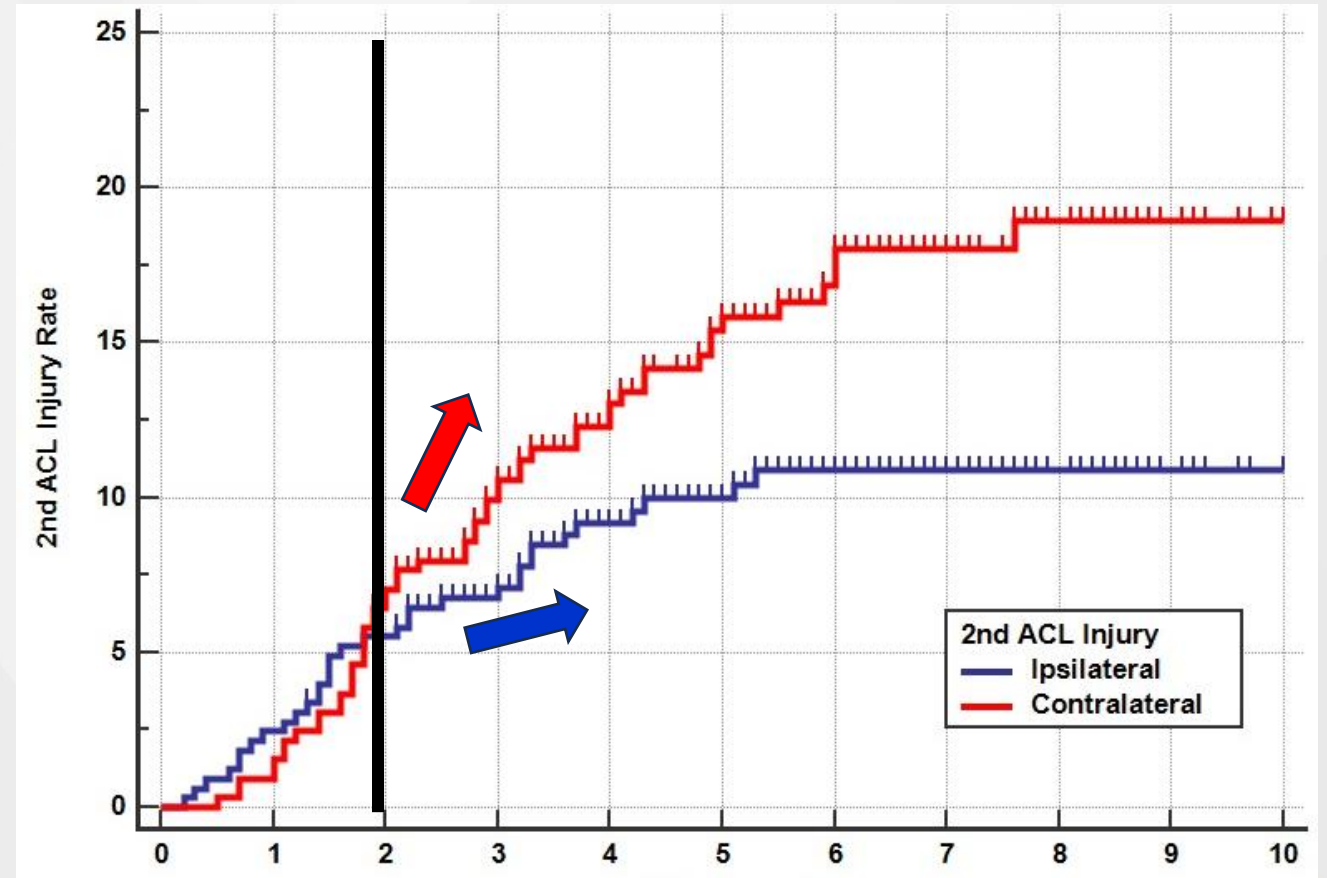
SPORT: 40% TEGNER ≥8; 60% TEGNER <8 (AVERAGE 7)

AVERAGE FOLLOW-UP: 7.1 ± 3.5 YEARS (range 2-14)



RESULTS

- **10%** (32) **IPSI**LATERAL
RE-RUPTURES
- **17%** (53) **CONTRALATERAL**
ACL RECONSTRUCTION
- **25%** (85) **2nd ACL INJURY**
(IPSI or CONTRA)



INCREASE OF CONTRALATERAL >2 YEARS (P=0.0299)



RESULTS

PREDICTORS OF RE-INJURY

Table 2: Logistic Regression Analysis of ACL Injury Risk									
Variables	Ipsilateral ACL Revision			Contralateral ACL Rupture			Second ACL Rupture		
	Odd Ratio	95% CI	p-value	Odd Ratio	95% CI	p-value	Odd Ratio	95% CI	p-value
Sex (male)	5.1	1.2 - 21.8	=0.0276*	2.1	1.0 - 4.4	=0.0456*	3.3	1.6 - 6.7	=0.0010*
Overweight (BMI ≥ 25)	0.3	0.1 - 1.3	=0.1144	1.5	0.7 - 2.9	=0.2878	0.9	0.5 - 1.7	=0.8395
Tegner Level (≥ 8)	1.3	0.6 - 2.7	=0.4354	1.1	0.6 - 2.0	=0.6574	1.2	0.8 - 1.9	=0.4581
Age (15 - 17 years)	1.1	0.4 - 3.1	=0.9007	1.1	0.6 - 2.3	=0.6818	1.1	0.6 - 1.9	=0.8011
Age (17 - 19 years)	1.7	0.6 - 4.6	=0.3181	0.4	0.2 - 0.9	=0.0189*	0.7	0.4 - 1.4	=0.3036
Overall model fit			=0.0069*			=0.0070*			=0.0031*

IPSILATERAL ACL REVISION: MALE SEX (5.1 OR)

CONTRALATERAL ACL REC: MALE SEX (2.1 OR), AGE 17-19 (OR 0.4 vs AGE 13-15)

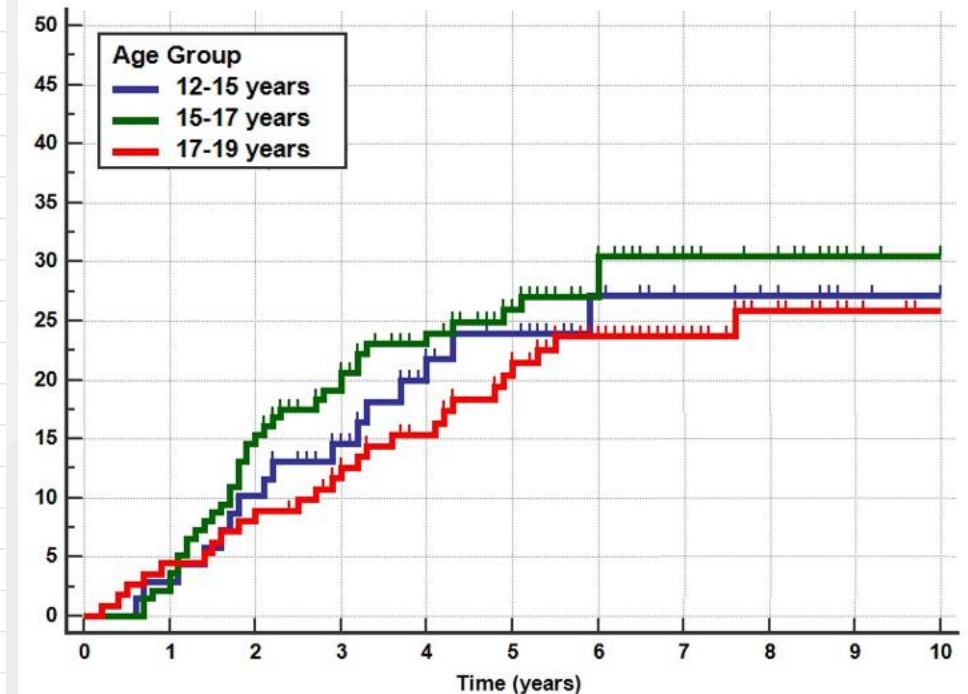
2nd ACL INJURY: MALE SEX (3.3 OR)



RESULTS

2nd ACL RE-INJURY (25% AT 7 YEARS)

Variable	Total No.	Second Ruptures	Cumulative rate (%)				Hazard Ratio (HR)		
			2-year	5-year	10-year	p-value	HR	95% CI	p-value
Age (All patients)	318	79 (24.8%)	11.9%	24.0%	28.2%	=0.5535			
13 - 15 years	69	16 (23.2%)	10.1%	23.9%	27.2%		Reference group		
15 - 17 years	137	37 (27.0%)	15.3%	25.9%	30.5%		n.s.		
17 - 19 years	112	26 (23.2%)	8.9%	21.5%	25.9%		n.s.		
Age (Males)	231	70 (30.3%)	14.7%	29.2%	34.8%	=0.3978			
13 - 15 years	42	13 (31.0%)	14.3%	34.7%	37.4%		Reference group		
15 - 17 years	96	32 (33.3%)	18.7%	31.5%	37.8%		n.s.		
17 - 19 years	93	25 (26.9%)	10.8%	24.6%	29.8%		n.s.		
Age (Tegner ≥8)	128	38 (29.7%)	15.6%	27.3%	31.8%	=0.1588			
13 - 15 years	23	10 (43.5%)	21.7%	45.1%	55.9%		Reference group		
15 - 17 years	50	15 (30.0%)	20.0%	26.8%	35.8%		n.s.		
17 - 19 years	55	13 (23.7%)	9.1%	20.2%	24.2%		n.s.		



SIMILAR TRENDS AMONG AGE GROUPS (p=n.s.)

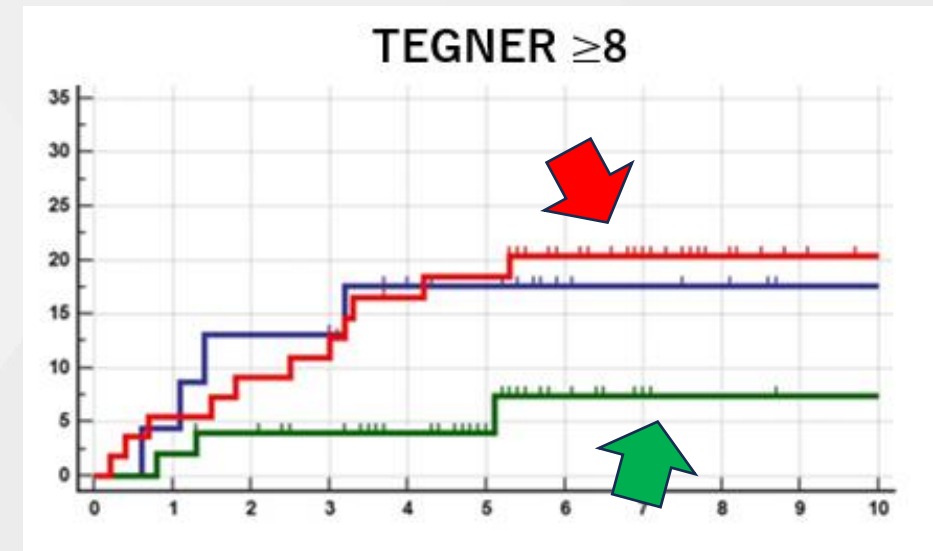
HIGHER (n.s.) RATE IN 13-15 YEARS WITH TEGNER ≥ 8 (44%)



RESULTS

IPSILATERAL ACL REVISION (10% AT 7 YEARS)

Variable	Total No.	Second Ruptures	Cumulative rate (%)				Hazard Ratio (HR)		
			2-year	5-year	10-year	p-value	HR	95% CI	p-value
Age (All patients)	318	32 (10.1%)	5.7%	9.9%	10.8%	=0.2371			
13 - 15 years	69	5 (7.3%)	4.3%	7.6%	7.6%		Reference group		
15 - 17 years	137	11 (8.0%)	4.4%	7.7%	8.9%		n.s.		
17 - 19 years	112	16 (14.3%)	8.0%	13.7%	14.9%		n.s.		
Age (Males)	231	30 (13.0%)	7.4%	12.7%	14.0%	=0.3459			
13 - 15 years	42	5 (11.9%)	7.1%	12.5%	12.5%		Reference		
15 - 17 years	96	9 (9.4%)	5.2%	8.9%	10.6%		n.s.		
17 - 19 years	93	16 (17.2%)	9.7%	16.5%	17.9%		n.s.		
Age (Tegner ≥8)	128	18 (14.1%)	7.8%	12.9%	15.0%	=0.1538			
13 - 15 years	23	4 (17.4%)	13.0%	17.6%	13.6%		Reference group		
15 - 17 years	50	3 (6.0%)	4.0%	4.0%	7.4%		n.s.		
17 - 19 years	55	11 (20.0%)	9.1%	18.5%	20.4%		n.s.		



DIFFERENT TRENDS (HIGHER IN 17-19 YEARS) BUT NOT SIGNIFICANT

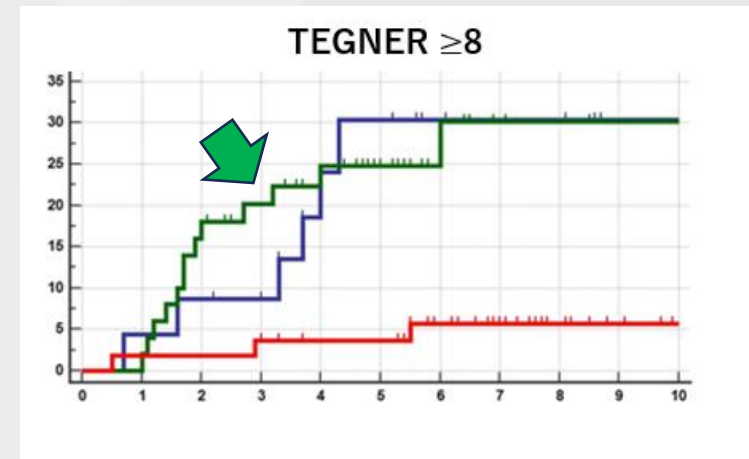
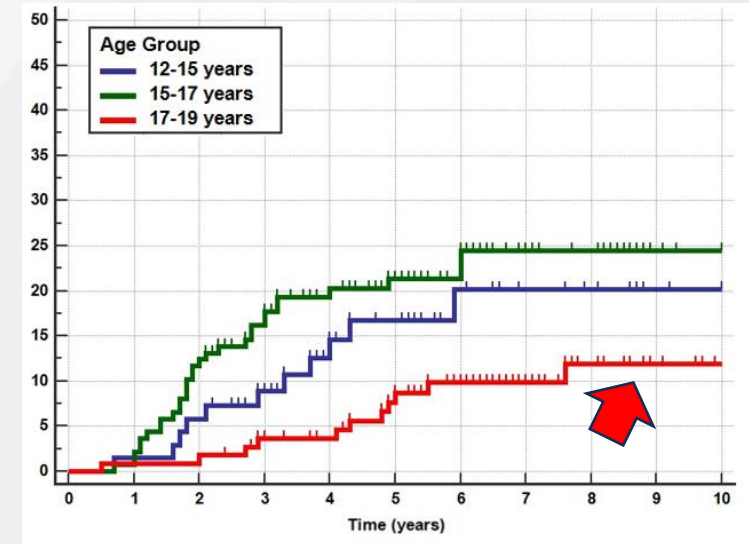
HIGHER (n.s.): 17-19 YEARS WITH TEGNER TEGNER ≥8 (20%)

LOWER (n.s.): 15-17 YEARS WITH TEGNER TEGNER ≥8 (6%)

RESULTS

CONTRALATERAL ACL REC (17% AT 7 YEARS)

Variable	Total No.	Second Ruptures	Cumulative rate (%)				Hazard Ratio (HR)		
			2-year	5-year	10-year	p-value	HR	95% CI	p-value
Age (All patients)	318	53 (16.7%)	7.2%	15.9%	10.0%	=0.0122			
13 - 15 years	69	12 (17.4%)	5.8%	16.7%	20.2%		Reference group		
15 - 17 years	137	30 (21.9%)	12.4%	21.3%	24.5%		n.s.		
17 - 19 years	112	11 (9.8%)	1.8%	8.7%	11.9%		0.47	(0.22 - 0.97)	<0.05
Age (Males)	231	44 (19.0%)	8.2%	18.0%	21.4%	=0.0074			
13 - 15 years	42	9 (21.4%)	7.1%	23.2%	23.2%		Reference group		
15 - 17 years	96	25 (26.0%)	14.6%	24.9%	29.3%		n.s.		
17 - 19 years	93	10 (10.8%)	2.2%	9.2%	13.1%		0.40	(0.17 - 0.94)	<0.05
Age (Tegner ≥8)	128	23 (30.4%)	9.4%	16.2%	18.7%	=0.0022			
13 - 15 years	23	7 (26.0%)	8.7%	30.3%	32.1%		Reference group		
15 - 17 years	50	13 (26.0%)	18.0%	24.7%	30.1%		n.s.		
17 - 19 years	55	3 (5.5%)	1.8%	3.6%	5.7%		0.15	(0.05 - 0.47)	<0.05



LOWER RATE IN 17-19 YEARS (10%) (p=0.0122)

HIGHER RATE IN 15-17 YEARS WITH TEGNER TEGNER ≥8 (26%) (p=0.002)

RESULTS

IPSILATERAL vs CONTRALATERAL (RE)INJURY

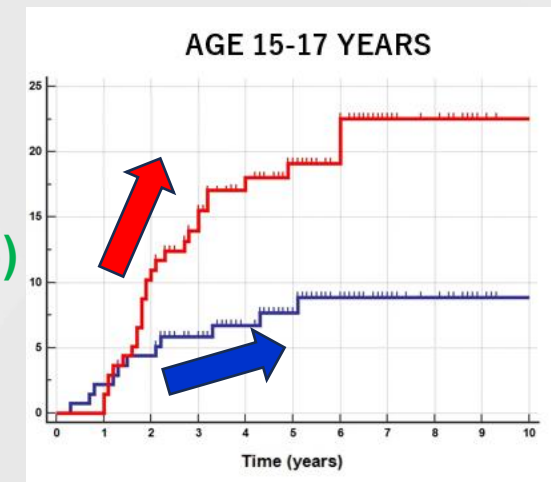
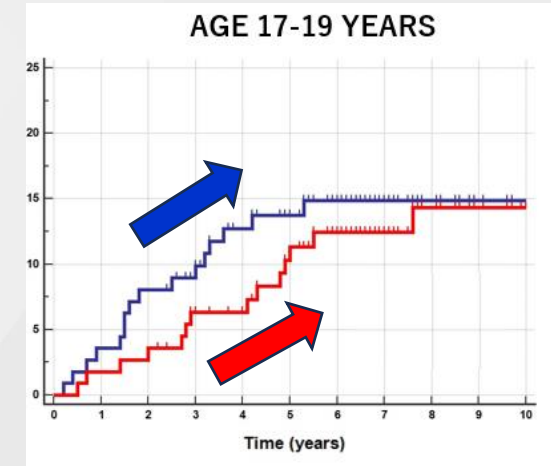
Variable	Total No.	Second Ruptures	Cumulative rate (%)				Hazard Ratio (HR)		
			2-year	5-year	10-year	p-value	HR	95% CI	p-value
All patients						=0.0299			
Ipsilateral ACL Revision	318	32 (10.1%)	5.7%	9.9%	10.8%			Reference group	
Contralateral ACL Injury	318	53 (16.7%)	7.2%	15.9%	19.0%		1.64	(1.08 - 2.50)	p<0.05
Males						=0.1096			
Ipsilateral ACL Revision	231	30 (13.0%)	7.4%	12.7%	14.0%			Reference group	
Contralateral ACL Injury	231	44 (19.0%)	8.2%	18.0%	21.4%			n.s.	
Tegner ≥8						=0.4580			
Ipsilateral ACL Revision	128	18 (14.1%)	7.8%	12.9%	15.0%			Reference group	
Contralateral ACL Injury	128	23 (30.4%)	9.4%	16.2%	18.7%			n.s.	
Age 13 - 15 years						=0.1179			
Ipsilateral ACL Revision	69	5 (7.3%)	4.3%	7.6%	7.6%			Reference group	
Contralateral ACL Injury	69	12 (17.4%)	5.8%	16.7%	20.2%			n.s.	
Age 15 - 17 years						=0.0066			
Ipsilateral ACL Revision	137	11 (8.0%)	4.4%	7.7%	8.9%			Reference group	
Contralateral ACL Injury	137	30 (21.9%)	12.4%	21.3%	24.5%		2.55	(1.35 - 4.82)	p<0.05
Age 17 - 19 years						=0.7336			
Ipsilateral ACL Revision	112	16 (14.3%)	8.0%	13.7%	14.9%			Reference group	
Contralateral ACL Injury	112	11 (9.8%)	1.8%	8.7%	11.9%			n.s.	

SIMILAR TRENDS

IN 17-19 YEARS (n.s)

**X2.5 RISK OF
CONTRALATERAL**

IN 15-17 YEARS (p=0.0066)



CONCLUSION

**YOUNGER TEENAGERS (13-15 YEARS) HAVE THE HIGHEST OVERALL RISK
OF SECOND ACL INJURY**

**MID TEENAGERS (15-17 YEARS) HAVE x2.5 RISK OF CONTALATERAL
RESPECT TO ACL RECONSTRUCTION FAILURE, ESPECIALLY AFTER 2 YEARS**

**OLDER TEENAGER (17-19 YEARS) HAVE THE HIGHEST IPSILATERAL RE-INJURY RISK
(SIMILAR TO CONTALATERAL)**

