

SUPPLEMENTARY INFORMATION

TABLE 1– HEIGHT, WEIGHT and BMI

Author (Year)	Study Design	No. of Subjects	Population Age Range	Population Sex	Outcome Measure	Summary	Level of Evidence
Rauh 2006 ¹⁴	Prospective Cohort	421	14-8 yr	186 F / 235 M high school cross country runners	Injuries	<ul style="list-style-type: none"> The overall incidence rate of injury was 17.0/1,000 AE. Runners with a BMI in the first (RR=0.8; 95% CI: 0.6, 1.1) and fourth (RR=1.1; 95% CI: 0.8, 1.5) quartiles had a similar injury risk as runners with a BMI in the combined second and third quartiles (reference group). 	2
Yagi 2013 ¹⁵	Cohort	230	14-18 yr	186 F / 235 M high school cross country runners	Shin pain (medial tibial stress syndrome & stress fracture)	<ul style="list-style-type: none"> Injury rate for medial tibial stress syndrome was 0.29/1000 AE (n=102) and for stress fracture was 0.06/1000 AE (n=21). In females, the odds of incurring medial tibial stress syndrome increased with BMI (adjusted OR, 0.51; 95% CI: 0.31, 0.86). 	4
Plisky 2006 ¹⁶	Prospective Cohort	105	13-18 yr	46 F / 59 M high school cross country runners	Medial tibial stress syndrome	<ul style="list-style-type: none"> Injury rate for medial tibial stress syndrome was 2.8/1000 AE overall Runners with a BMI in the third quartile (20.2-21.6 kg/m²) had 7.3 times greater odds of developing medial tibial stress syndrome (OR=7.3, 95% CI: 1.2, 43.5) than runners in the second quartile (18.8-20.1 kg/m² [reference group]). 	2
Tenforde 2013 ¹⁷	Prospective Cohort	748	13-18 yr	442 F / 306 M high school runners	Stress fractures	<ul style="list-style-type: none"> Prospective stress fractures in 5.4% of girls (n = 23) and 4.0% of boys (n = 11). BMI < 19 kg/m², (HR=2.67; 95% CI: 1.11, 6.41) was an independent risk factors for stress fractures in girls. 	2

BMI, body mass index; HR, hazard ratio; OR, odds ratio; RR, rate ratio, CI, confidence interval; AE, athletic exposure

REFERENCES: TABLE 1– HEIGHT, WEIGHT and BMI

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TABLE 2 – AGE

Author (Year)	Study Design	No. of Subjects	Population Age Range	Population Sex	Outcome Measure	Summary	Level of Evidence
Mehl 2011 ⁴	Descriptive Epidemiology	6327	6-18 yr	3064 F / 3263 M runners	Injuries	<ul style="list-style-type: none"> Overall annual injury was 30.7 injuries per 100,000 US population and increased 21.0% during the study period, from 24.2 injuries per 100,000 US population in 1994 to 29.3 injuries per 100,000 U.S. population in 2007. Children aged 12-14 yr had the highest injury rate, 45.8 injuries per 100,000 US population. 	4
Roberts 2010 ¹⁸	Retrospective Cohort	310	7-17 yr	85 F / 225 M marathon runners	Medical encounters	<ul style="list-style-type: none"> 310 youth successfully finished Twin Cities Marathon over 26 years with only 4 requiring post-race medical encounter. The risk for an acute race day medical attention in youths was less than, but not significantly different from adults (odds ratio =0.52, 95% CI: 0.19, 1.39). 	4
Rauh 2014 ¹⁹	Prospective Cohort	421	13-18 yr	186 F / 235 M high school cross country	Injuries	<ul style="list-style-type: none"> Age was not significantly different between runners who did (15.6±1.3 yr) and did not (15.6±1.1 yr) sustain an injury (P = 0.80). For girls, age was not significantly different between runners who did (15.7±1.2 yr) and did not (15.6±1.1 yr) sustain an injury. (P=0.65) For boys, age was not significantly different between runners who did (15.4±1.4 yr) and did not (15.6±1.2 yr) sustain an injury. (P=0.38) 	2
Bennett 2001 ²⁰	Prospective Cohort	125	13-18 yr	68 F / 57 M high school cross country	Medial tibial stress syndrome	<ul style="list-style-type: none"> Age was not significantly different between runners who did (15.3±1.0 yr) and did not (15.7±1.5 yr) develop medial tibial stress syndrome. 	4
Huxley 2014 ²¹	Prospective Cohort	103	13-17 yr	66 F / 34 M / 3 Unidentified Elite track and field	Injuries	<ul style="list-style-type: none"> Injured athletes self-reported training at a higher weekly intensity and a higher yearly training load at 13-14 years (p<0.01) compared to uninjured athletes Injured athletes reported training was 'harder' each week than uninjured athletes at 13-14 years (p<0.01). and at 15-16 years (p<0.05) 	4

REFERENCES: TABLE 2 – AGE

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TABLE 3 – SEX

Author (Year)	Study Design	No. of Subjects	Population Age Range	Population Sex	Outcome Measure	Summary	Level of Evidence
Rauh 2006 ¹⁴	Prospective Cohort	421	14-18 yr	186 F / 235 M high school cross country	Injuries	<ul style="list-style-type: none"> Girls had a higher overall injury rate (19.6/1,000 AEs) than boys did (15.0/1,000 AE) (incidence rate ratio=1.3, 95% CI: 1.0, 1.6). Compared with boys, girls had significantly higher rates of injuries resulting in ≥15 days of disability (incidence rate ratio=3.2, 95% CI: 1.4-8.0). 	2
Plisky 2006 ¹⁶	Prospective Cohort	105	13-18 yr	46 F / 59 M high school cross country	Medial tibial stress syndrome	<ul style="list-style-type: none"> Overall injury rate for girls was 4.3/1000 AE and for boys was 1.7/1000 AE (rate ratio=2.5, 95% CI: 0.9, 8.2). 	2
Tenforde 2013 ¹⁷	Prospective Cohort	748	13-18 yr	442 F / 306 M high school runners	Stress fractures	<ul style="list-style-type: none"> 32 injuries occurred in 5.4% of girls (n=23). 12 injuries occurred in 4.0% of boys (n=11). 	2
Bennett 2001 ²⁰	Prospective Cohort	125	13-18 yr	68 F / 57 M high school cross country	Medial tibial stress syndrome	<ul style="list-style-type: none"> Injuries occurred in 19.6% of girls and 3.6% of boys. Sex was associated with medial tibial stress syndrome ($\chi^2=7.15$, $df=1$, $p=0.007$ with 24% of the variability in occurrence of injury is due to sex). 	4
Tirabassi 2016 ²²	Descriptive Epidemiology	National database	high school aged	NA	Injuries (medical disqualification)	<ul style="list-style-type: none"> Medial disqualification injury rates were higher among girls than boys for cross country (rate ratio=2.6; 95% CI: 1.0, 7.5) and track and field (rate ratio=2.6; 95% CI: 1.7, 4.0). 	4
Changstrom 2015 ²³	Descriptive Epidemiology	389	13-19 yr	210 F / 179 M high school	Stress fractures	<ul style="list-style-type: none"> Stress fracture injury rates for girls' cross country (10.62/100,000 AE) was higher than boys' cross country (5.42/100,000 AE) (rate ratio=1.75; 95% CI: 1.38, 2.23). 	4
Reinking 2010 ²⁴	Prospective Cohort	125	13-18 yr	62 F / 63 M high school cross country	Exercise-related leg pain	<ul style="list-style-type: none"> No difference between girls and boys in occurrence of exercise-related leg pain (RR=0.93, 95% CI: 0.61, 1.42) 	2
Rauh 2000 ²⁵	Prospective Cohort	3233	14-18 yr	1202 F / 2031 M high school cross country	Injuries	<ul style="list-style-type: none"> Girls had a higher injury rate (16.7/1,000 AE) than boys (10.9/1,000AE) (rate ratio=1.5, 95% CI: 1.4, 1.7). Girls had a higher rate of subsequent injury to the same body part (44.1/1,000 AE) than boys (37.6/1,000AE) (rate ratio=1.4, 95% CI: 1.2, 1.6). 	2

Beachy 1997 ²⁶	Descriptive Epidemiology	4,024	7 th -12 th grade	787 F / 501 M high school & middle school cross country 1531 F / 1205 M high school & middle school track & field	Injuries	<ul style="list-style-type: none"> • Cross country: Injury occurrence for boys was 48% and girls was 47.0%. • Track & Field: Injury occurrence for boys was 48% and girls was 52.0%. 	4
McLain 1989 ²⁷	Descriptive Epidemiology	229	9 th -12 th grade	40 F / 54 M high school cross country 65 F / 70 M high school track & field	Injuries	<ul style="list-style-type: none"> • Cross country: Injury occurrence for boys was 13.0% and girls was 7.5%. • Track & Field: Injury occurrence for boys was 10.0% and girls was 18.5%. 	4
Lowe 1987 ²⁸	Descriptive Epidemiology	634	9 th -12 th grade	63 F / 125 M high school cross country 167 F / 279 M high school track & field	Injuries	<ul style="list-style-type: none"> • Cross country: Injury occurrence for boys was 1.6% and girls was 1.6%. • Track & Field: Injury occurrence for boys was 1.4% and girls was 1.2%. 	4
Chandy 1985 ²⁹	Prospective Cohort	12,920	9 th -12 th grade	711 F / 1567 M high school cross country 4235 F / 6407 M high school track & field	Injuries	<ul style="list-style-type: none"> • Cross country: Injury occurrence for boys was 1.5% and girls was 1.1%. • Track & Field: Injury occurrence for boys was 1.6% and girls was 1.1%. 	4
Shively 1981 ³⁰	Prospective Cohort	3,399	9 th -12 th grade	187 F / 389 M high school cross country 1141 F / 1682 M high school track & field	Injuries	<ul style="list-style-type: none"> • Cross country: Injury occurrence for boys was 2.3% and girls was 0.0%. • Track & Field: Injury occurrence for boys was 1.7% and girls was 0.7%. 	4

Garrick 1978 ³¹	Prospective Cohort	167	9 th -12 th grade	26 F / 141 M high school cross country	Injuries	<ul style="list-style-type: none"> Injury occurrence for boys was 29.1% and girls was 34.6%. 	4
Pierpoint 2016 ³²	Descriptive Epidemiology	NA	9 th -12 th grade	NA	Injuries	<ul style="list-style-type: none"> Girls had higher overall injury rates (rate ratio=1.37; 95% CI: 1.27, 1.48) and practice injury rates (rate ratio=1.60; 95% CI: 1.46, 1.76) than boys. 	4
Knowles 2006 ³³	Prospective Cohort	2,269	9 th -12 th grade	1266 F / 1003 M high school track & field	Injuries	<ul style="list-style-type: none"> Injury rates for girls was 1.18/1,000 AE (95% CI: 0.75, 1.83) and boys was 1.06/1,000 AE (95% CI: 0.62, 1.81). 	2
Watson 1987 ³⁴	Prospective Cohort	234	9 th -12 th grade	78 F / 156 M high school track & field	Injuries	<ul style="list-style-type: none"> Injury occurrence for boys was 19.1% and girls was 14.1%. 	4
Requa 1981 ³⁵	Prospective Cohort	516	9 th -12 th grade	208 F / 308 M high school track & field	Injuries	<ul style="list-style-type: none"> Injury occurrence for boys was 32.8% and girls was 35.1%. 	4
Beachy 2014 ³⁶	Prospective Cohort	4,592	7 th -8 th grade	756 F / 710 M middle school cross country 1537 F / 1589 M middle school track & field	Injuries	<ul style="list-style-type: none"> Cross-country: Girls had higher rate of injuries (10.9/1000 AE) than boys (8.0/1000 AE) (rate ratio=1.36, 95% CI 1.2, 1.6). Track & Field: Girls had higher rate of injuries (12.2/1000 AE) than boys (8.3/1000 AE) (rate ratio=1.46, 95% CI 1.2, 1.6). 	4

CI, confidence interval; AE, athletic exposure

REFERENCES: TABLE 3 – SEX

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TABLE 4 – PREVIOUS INJURY

Author (Year)	Study Design	No. of Subjects	Population Age Range	Population Sex	Outcome Measure	Summary	Level of Evidence
Rauh 2006 ¹⁴	Prospective Cohort	421	14-18 yr	186 F / 235 M high school cross country	Injuries	<ul style="list-style-type: none"> Overall injury rate of 17.0/1000 AE Overall rate of re-injury to same body part was highest in the shin (73.6/1000 AE), hip (53.8/1000 AE) and knee (41.8/1000 AE) Previous injury (adjusted RR 1.2, 95% CI: 1.0, 1.5) and summer preseason injury (adjusted RR 1.4, 95% CI: 1.0, 1.9) were associated with future injury 	2
Plisky 2006 ¹⁶	Prospective Cohort	105	13-18 yr	46 F / 59 M high school cross country	MTSS	<ul style="list-style-type: none"> Overall MTSS injury rate of 2.8/1000 AE Runners with a previous injury were at greater odds (OR=2.2, 0.7, 6.4) of developing MTSS than runners without prior injury. 	2
Tenforde 2013 ¹⁷	Prospective Cohort	748	13-18 yr	442 F: / 306 M high school runners	Stress fractures	<ul style="list-style-type: none"> Stress fractures occurred in 5.4% of girls (n = 23) and 4.0% of boys (n = 11). Prior fracture was an independent risk factor for stress fractures in girls (HR 5.83, 95% CI: 2.32, 14.67) and boys (HR 5.73, 95% CI: 1.52, 21.67). 	2
Reinking 2010 ²⁴	Prospective Cohort	125	13-18 yr	62 F / 63 M high school cross country	Exercise-related leg pain	<ul style="list-style-type: none"> 103/125 respondents (82.4%) reported a history of exercise-related leg pain. 45/93 respondents (48%) reported experiencing exercise-related leg pain during the season. Runners with a history of exercise-related leg pain were at 9 times greater risk of exercise-related leg pain during the season (RR=9.14, 1.36-61.59) than runners without a history. 	2
Rauh 2000 ²⁵	Prospective Cohort	3233	14-18 yr	1202 F / 2031 M high school cross country	Injuries	<ul style="list-style-type: none"> Initial injury rate was 8.7/1,000 AE. Subsequent injury rates were 37.6/1,000 AE to the same body part and 3.7/1,000 AE to a new body part. 	2

AE, athletic exposure; RR, rate ratio; OR, odds ratio; HR, hazard ratio; CI, confidence interval

REFERENCES: TABLE 4 – PREVIOUS INJURY

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TABLE 5 – ALIGNMENT and STRENGTH

Author (Year)	Study Design	No. of Subjects	Population Age Range	Population Sex	Outcome Measure	Summary	Level of Evidence
Yagi 2013 ¹⁵	Cohort	230	14-18 yr	96 F / 134 M high school cross country	Shin pain (Medial tibial stress syndrome & stress fracture)	<ul style="list-style-type: none"> Increased internal rotation of the hip significantly decreased the odds of sustaining medial tibial stress syndrome in females (adjusted OR=0.91; 95% CI: 0.85, 0.99). Increased straight leg raise significantly increased the risk of stress fracture in males (adjusted OR=1.38; 95 % CI: 1.04, 1.83). 	4
Plisky 2006 ¹⁶	Prospective Cohort	105	13-18 yr	46 F / 59 M high school cross country	Medial tibial stress syndrome	<ul style="list-style-type: none"> Runners with a navicular drop >10mm were at the same risk (OR=0.9; 95% CI: 0.3, 2.8) than runners with a navicular drop <10mm. 	2
Rauh 2007 ³⁷	Prospective Cohort	393	14-18 yrs	171 F / 222 M high school cross country	Injuries	<ul style="list-style-type: none"> Runners with a Q-angle $\geq 20^\circ$ had higher risk of injury than runners with a Q-angle $< 20^\circ$ (rate ratio=1.7; 95% CI: 1.2, 2.4). Runners with a right-left Q-angle difference $\geq 4^\circ$ had a higher injury risk than runners with a right-left Q-angle difference $< 4^\circ$ (rate ratio=1.8; 95% CI: 1.4, 2.5). 	2
Rauh 2018 ³⁸	Prospective Cohort	393	14-18 yrs	171 F / 222 M high school cross country	Injuries	<ul style="list-style-type: none"> Boys with a leg-length inequality >1.5 cm had higher odds of injury than boys with a leg-length inequality <0.5 cm (OR=7.47, 95% CI: 1.5, 36.9). 	4
Luedke 2015 ³⁹	Prospective Cohort	68	13-18 yrs	47 F / 20 M high school cross country	Injuries	<ul style="list-style-type: none"> Runners in the tertiles indicating weakest hip abductors (p=0.046), knee extensor (p=0.038), and hip knee flexor muscle strength (p=0.046) had higher occurrence of anterior knee pain. 	2
Finnoff 2011 ⁴⁰	Prospective Cohort	98	14-18 yrs	45 F / 53 M high school cross country	Patellofemoral pain	<ul style="list-style-type: none"> Greater baseline hip abduction strength (OR=5.35, 95% CI: 1.46-19.53) and abduction-to-adduction strength ratio (OR=14.14, 95% CI: 0.90, 221.06) increased the odds of patellofemoral pain. Greater pre-injury hip ER:IR strength ratio decreased the odds of patellofemoral pain (OR=0.01, 95% CI: <0.01, 0.44). 	2

CI, confidence interval; OR, odds ratio

REFERENCES: TABLE 5 – ALIGNMENT and STRENGTH

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TABLE 6 - BONE STRESS INJURY

Author (Year)	Study Design	No. of Subjects	Population Age Range	Population Sex	Outcome Measure	Summary	Level of Evidence
Tenforde 2013 ¹⁷	Prospective Cohort	748	13-18 yr	442 F / 306 M high school	Stress fractures	<ul style="list-style-type: none"> Prospective stress fractures in 5.4% of girls (n = 23) and 4.0% of boys (n = 11). Tibial stress fractures were most common in girls, and the metatarsus was most frequently fractured in boys. Independent risk factors for stress fractures in girls included: prior fracture (HR 5.83, 95% CI: 2.32, 14.67), body mass index < 19 kg/m², (HR 2.67, 95% CI: 1.11, 6.41) late menarche (age menarche ≥15 yr), (HR 2.49, 95% CI: 1.01, 6.17) and previous participation in gymnastics or dance (HR 3.13, 95% CI: 1.20, 9.15). Independent risk factors for stress fractures in boys included prior fracture (HR 5.73, 95% CI: 1.52, 21.67) and increased number of seasons (HR 2.35, 95% CI: 1.12, 5.00). 	2
Changstrom 2015 ²³	Descriptive Epidemiology	389	13-19 yr	210 F / 179 M high school athletes	Stress fractures	<ul style="list-style-type: none"> Overall stress fracture injury rate of 1.54/100,000 AE. The most commonly injured sites were the lower leg (40.3% of all stress fractures), foot (34.9%), and lower back/lumbar spine/pelvis (15.2%). Stress fracture injury rates were 10.62/100,000 AE for girls' cross country and 5.42/100,000 for boys' cross country. Girls sustained more stress fractures (63.3%) than boys (36.7%) and had higher rates of stress fracture (2.22 vs 1.27; rate ratio, 1.75; 95% CI: 1.38, 2.23). 	4
Field 2011 ⁴⁴	Prospective Cohort	6831	9-15 yr	6831 F adolescents	Stress fractures	<ul style="list-style-type: none"> During seven years of follow-up, 267 females (3.9%) developed a stress fracture. Hours per week of running (RR=1.13, 95% CI: 1.04, 1.23), basketball (RR=1.12, 95% CI 1.03, 1.22) and cheerleading and gymnastics (RR=1.12, 95% CI 1.02, 1.23) were significant predictors of developing a stress fracture independent of age, age at menarche, family history of fracture, and hours per week of low- and moderate-impact activity. 	2

BMD, bone mineral density; RR, relative risk; HR, hazard ratio; CI, confidence interval; AE = athletic exposure

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TABLE 7 - LOW BMD and MENSTRUAL DYSFUNCTION

Author (Year)	Study Design	No. of Subjects	Population Age Range	Population Sex	Outcome Measures	Summary	Level of Evidence
Rauh 2014 ⁴⁵	Prospective Cohort	89	13-18 yr	89 F high school cross country and track	Musculoskeletal injuries	<ul style="list-style-type: none"> Low BMD relative to age (BMD Z-score of ≤ -1SD) was significantly associated (adjusted OR=4.6, 95% CI: 1.5, 13.3) with increased injury occurrence. Among those with BMD Z-score of ≤ -2SD, a history of oligo/amenorrhea was significantly associated (adjusted OR=4.1, 95% CI: 1.2, 13.5) with increased injury occurrence. 	2
Barrack 2017 ⁴⁷	Cross-sectional	69	13-19 yr	51 M athletes	Low BMD (BMD Z-score ≤ -1.0)	<ul style="list-style-type: none"> Single risk factors of low BMD included $<85\%$ expected weight (OR=5.6, 95% CI: 1.4, 22.5) and average weekly mileage >30 in the past year (OR=6.4, 95% CI: 1.5, 27.1). The strongest two-variable and three-variable risk factors included weekly mileage >30 + stress fracture history (OR=17.3, 95% CI: 1.6, 185.6) and weekly mileage >30 + $<85\%$ expected weight + stress fracture history (OR=17.3, 95% CI: 1.6, 185.6), respectively. Risk factors were cumulative when predicting low BMD (including $<85\%$ expected weight, weekly mileage >30, stress fracture history and <1 serving of calcium-rich food/day): 0-1 risk factors (11.1%), 2 risk factors (42.9%), or 3-4 risk factors (80.0%). 	4
Tenforde 2015 ⁴⁸	Cross-sectional	136	13-19 yr	94 F / 42 M high school runners	BMD Z-score	<ul style="list-style-type: none"> In girls, risk factors for lower lumbar BMD Z-scores included: lower android-to-gynoid fat mass ratio ($\beta=0.49$), higher fat mass ($\beta=-0.30$), being shorter ($\beta=0.33$), and the interaction between current menstrual irregularity and a history of fracture ($\beta=-1.18$). In girls, risk factors for lower total body less head BMD Z-scores included: later age of menarche ($\beta=-0.26$), lower android-to-gynoid fat mass ratio ($\beta=0.17$), lower lean mass ($\beta=0.33$), and drinking less milk ($\beta=0.19$). In boys, risk factors for lower lumbar BMD Z-scores included: lower BMI Z-score ($\beta=0.57$) and the belief that being thinner improves performance ($\beta=-0.90$). In boys, risk factors for lower total body less head BMD Z-scores included: lower BMI Z-score ($\beta=0.60$) and the belief that being thinner improves performance ($\beta=-0.46$), and lower android-to-gynoid fat mass ratio ($\beta=0.25$). 	2

						<ul style="list-style-type: none"> Girls with a BMI ≤ 17.5 kg/m² or both menstrual irregularity and a history of fracture more frequently had BMD Z-score ≤ -1.0. Boys with a BMI ≤ 17.5 kg/m² and belief that thinness improves performance more frequently had BMD Z-score ≤ -1.0. 	
Barrack 2014 ⁵⁰	Prospective Cohort	259	13-29 yr	56 F (age < 18 yr) athletes	Bone stress injury	<ul style="list-style-type: none"> 28 participants (10.8%) developed a bone stress injury. Single factors associated with the development of bone stress injury included ≥ 12 h/wk of purposeful exercise (OR=4.9; 95% CI: 1.4, 16.9), BMI <21.0 kg/m² (OR=2.4; 95% CI: 1.0, 5.3), and BMD Z score <-1.0 (OR=3.2; 95% CI: 1.4, 7.2). The strongest 2- and 3-variable combined risk factors for bone stress injury were low BMD (Z score <-1.0) + ≥ 12 h/wk of exercise (OR=5.1; 95% CI: 2.2, 12.1) and ≥ 12 h/wk of exercise + leanness sport/activity + dietary restraint (OR, 8.7; 95% CI: 2.7, 28.3). 	2

BMI, body mass index; BMD, bone mineral density; OR, odds ratio; β =beta coefficient; CI, confidence interval

REFERENCES: TABLE 7 - LOW BMD and MENSTRUAL DYSFUNCTION

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TABLE 8 – TRAINING

Author (Year)	Study Design	No. of Subjects	Population Age Range	Population Sex	Outcome Measure	Summary	Level of Evidence
Rauh 2006 ¹⁴	Prospective Cohort	421	14-18 yr	186 F / 235 M high school cross country	Injuries	<ul style="list-style-type: none"> No association to injury risk for: running experience, pre-season number of weeks, pre-season frequency d/wk, pre-season average weekly distance, training pace, training surface or terrain. 	2
Rauh 2014 ¹⁹	Prospective Cohort	421	14-18 yr	186 F / 235 M high school cross country	Injuries	<ul style="list-style-type: none"> Runners who ran <8 wks during summer had higher odds of incurring injury during first month of season (OR=2.7, 95% CI 1.2, 5.8). Runners who only alternated mileage 25% or less during summer had higher odds of incurring injury during the first month of season (OR=3.0, 95% CI 1.4, 6.4). Runners who ran predominantly on hills >33% each run (OR=12.3, 95% CI: 2.9, 52.5) or flat irregular terrains >33% each run (OR=12.3, 95% CI: 2.2, 6.2) had higher odds of incurring an injury during first month of season for girl runners only. 	2
Huxley 2014 ²¹	Prospective Cohort	103	13-17 yr	66 F / 34 M / 3 Unidentified Elite track and field	Injuries	<ul style="list-style-type: none"> Injured athletes trained at a higher intensity at 13-14 years, completed more high-intensity training sessions at 13-14 years and 15-16 years, and had a higher yearly training load at 13-14 years. 	4
Luedke 2016 ⁵¹	Prospective Cohort	68	13-18 yrs	47 F / 20 M high school cross country	Injuries	<ul style="list-style-type: none"> Runners with step rate < 166 steps/min at self-selected running speed were at greater odds of incurring a shin injury (OR=5.85, 95% CI: 1.1-32.1). Runners with step rate ≤ 164 steps /min at fixed running speed (3.3 m/s) were more likely to incur shin injury (OR=6.67, 95% CI: 1.2-36.7). 	2
Timpka 2015 ⁵²	Prospective Cohort	110	mean age =17 yrs	64 F / 46 M Swedish track and field	Overuse injuries	<ul style="list-style-type: none"> In assessing training load index (reported intensity x minutes of training per week), athletes in the third quartile (HR=1.76, 95% CI: 1.13-2.76, p=0.013) and fourth quartile (HR=1.81, 95% CI 1.18-2.80, p=0.007) had almost twice the risk of overuse injury compared to their peers in in the first quartile. 	4
Tenforde 2011 ⁵³	Retrospective Cohort	748	13-18 yrs	442 F / 306 M high school cross country & track and field	Overuse injuries	<ul style="list-style-type: none"> Compared to girls with no injury, girls with previous injury reported a greater percentage of miles on pavement (55% vs 49%). Compared to boys with no injury, boys with previous injury reported greater average weekly miles over past year (17.1±11.9 vs 14.1 ± 11.5 miles). 	3

CI, confidence interval; OR, odds ratio; HR, hazard ratio

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TABLE 9 – FOOTWEAR and FOOTSTRIKE

Author (Year)	Study Design	No. of Subjects	Population Age Range	Population Sex	Outcome Measure	Summary	Level of Evidence
Aibast 2017 ⁵⁷	Observational	76	12-18 yr	38 F / 38 M adolescents	Injuries	<ul style="list-style-type: none"> Lower-limb injury prevalence was 8% in habitually barefoot and 61% in habitually shod participants ($p = 0.01$). Habitually barefoot participants spent more time engaged in moderate to vigorous physical activity compared to habitually shod subjects (60+26 min/d vs 31+13 min/d; $p < 0.001$) 	3
Hollander 2018 ⁶²	Cross-sectional observational	678	6-18 yr	335 F / 343 M children	Rearfoot strike pattern	<ul style="list-style-type: none"> Habitually barefoot children showed a higher probability of using a rearfoot strike than habitually shod children ($p < 0.001$). The probability of rearfoot strike decreased in habitually barefoot children with age (OR_{barefoot-jogging} = 0.82, 95% CI: 0.71, 0.96; OR_{barefoot-running} = 0.58, 95% CI: 0.50, 0.67; OR_{shod-running} = 0.68, 95% CI, 0.59, 0.79). In habitually shod children, the probability of rearfoot strike increased during shod jogging (OR=1.19, 95% CI: 1.05, 1.35). 	3

OR, odds ratio; CI, confidence interval

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