APPENDIX 1 – Systematic Search Strategy and Article Selection

Table A1 – Example search categories and terms:

Category	Search Terms
Population	Athlet*, sport*
Method	Systematic review, Consensus statement
Outcome (Injury)	Injur*, illness*, strain, sprain, incidence, overuse, overreach*, accidents, stress, wellness, recover*
Workload	Training, resistance training, external load, internal load, workload, acute:chronic workload ratio, congested calendar, physical exertion, session RPE, global position systems, accelerometry, intensity, duration, physical fitness, fatigue

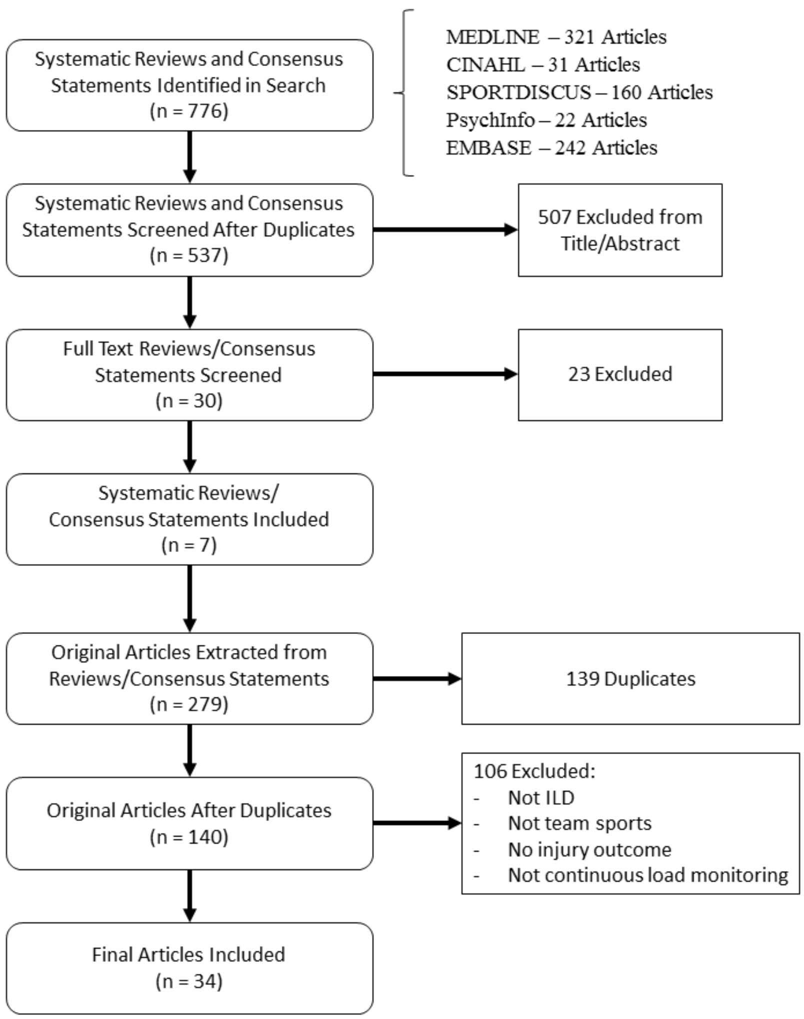

Figure A1 – Flow chart of included articles

APPENDIX 2 – TABLE A2: Expanded Table of 3-Fold Alignment (With Descriptions)

		Themes of theoretical model			Themes of temporal design: intensive longitudinal data				Statistical summary and typical uses
Method	n	Multifactorial aetiology	Between and within-athlete differences	Complex system	Includes time-varying and time-invariant variables	Missing/unbalanced data (due to rep. measures)	Repeated measure dependency	Incorporates time in the analysis	
Correlation (Pearson and Spearman)	10	X	X	X	X	X	X	X	7 of the 10 articles correlated team loads with injury incidence (team-level). Of those at the individual level, 2 looked at # of pre-season sessions and % in-season completed, and 1 looked at training load and injury subscale on the REST-Q.
Anderson - 2003 Bresciani - 2010 Books - 2008 Gabbett - 2004 Gabbett Jenkins - 2011 Killen 2010 Mallo Dellal - 2012 Murray Gabbett - 2016 Owen - 2015 Windt – 2016		Can only handle one x and one y variable.	Correlation could be at the team level (training load and # of injuries), or on individual level with quantitative outcome, but cannot differentiate within/between athlete differences.	No interactions between multiple predictors	No, assumes independent observations.	Assumes one observation per research participant/study unit, so participants couldn't have different numbers of observations.	In this case the correlation assumes independent observations so dependency is not taken into account.	Could, through having time as one of the variables, but cannot account for temporality	
Unpaired t-test	6	X	X	X	X	X	X	X	Generally, compared injured and uninjured players across a season. A group comparison of loading across the year fails to account for between/within athlete considerations and doesn't specify temporality.
Dennis et al., 2003 Dennis et al., 2005 Duhig et al - 2016 Owen et al., 2015 Saw et al., 2011 Visnes Bahr., 2013		Can only handle one x (grouping) and one y (outcome) variable	Only between-athlete differences (injured vs. uninjured)	No interactions between multiple predictors	Independent samples t-test compare group means on either a time-varying (e.g average workload) or time-invariant variable (e.g. height), not both.	No, assumes one observation per research participant/study unit, so by design forces a balanced set (1 observation per participant)	By definition, assumes independence	None included time in the analysis.	

		Themes of theoretical model			Themes of temporal design: intensive longitudinal data				Statistical summary and typical uses
Method	n	Multifactorial aetiology	Between and within-athlete differences	Complex system	Includes time-varying and time-invariant variables	Missing/unbalanced data (due to rep. measures)	Repeated measure dependency	Incorporates time in the analysis	
Chi-Square Tests	1	X	X	X	X	X	X	X	
Murray - 2016 - IJSPP		Only examines load groups and injury incidence	Examines differences in injury incidence across different load groups only	No interactions between multiple predictors	Included load groups and injury incidence only	Forces 1 observation (aggregated variable) per participant	Designed for independent observations and groups	Only included load groups and injury incidence	
Relative Risk Calculations	8	O	X	X	X	X	X	X	Many of these RR approaches seem to use RRs that traditionally require independence, but do not account for this in their analysis.
Bowen - 2016 Dennis - 2003 Dennis - 2005 Hulin - 2014 Hulin - 2016 Hulin - 2016 Murray - 2016 - Scand.		In some cases, authors examined relative risks of loading groups after subdividing across another variable, like chronic workload, making it multifactorial. Other authors only examined risks across load groups.	No differentiation, and independence assumed	No interactions between multiple predictors	Only loading (time-varying variables included)	Assumes independence of observations	Assumes independence	Uses weeks as unit of analysis but no incorporation of time into the calculations	

		Themes of theoretical model			Themes of temporal design: intensive longitudinal data				Statistical summary and typical uses
Method	n	Multifactorial aetiology	Between and within-athlete differences	Complex system	Includes time-varying and time-invariant variables	Missing/unbalanced data (due to rep. measures)	Repeated measure dependency	Incorporates time in the analysis	
Regression (logistic, linear, multinomial)	13	O	X	X	X	X	X	X	
Arnason 2004 - Regular logistic Bowen - 2016 - Regular logistic Brink - 2010 - Regular multinomial Colby - 2014 - Regular logistic Duhig - 2016 - Regular logistic Gabbett Domrow - 2007 - Regular linear Hulin - 2014 - Regular logistic Hulin - 2016 - Regular logistic Hulin - 2016 - Regular logistic Murray - 2016 - Regular logistic (Scand) Owen - 2015 - Regular linear Rogalski - 2013 - Regular logistic Visnes Bahr - 2013 - Regular logistic		Some authors include multiple variables, others only single load measurements independently	Assume independent observations, so cannot examine within-athlete differences	None included interactions between predictors	Assumes 1 observation per unit Becomes time invariant on aggregation In this case, some authors have included both, but in doing so violate the independence assumption	No, assumes one observation per athlete or research unit	Assumes independence. Visnes & Bahr (2013) do take it into account through logistic regression, but do not have the benefit of ILD	Assumes 1 observation per unit	
Paired t-test	2	X	X	X	X	X	√	√	
Saw et al., 2011 Dennis et al., 2003		No, only one variable (before/after) and outcome (load)	Only examines within-athlete differences	No interactions between multiple predictors	No - only time-varying variables	All subjects must have 2 'observations'	By definition, accounts for repeated measures through paired sample	Time is incorporated as pre-injury and 'injury' blocks of time	

		Themes of theoretical model			Themes of temporal design: intensive longitudinal data				Statistical summary and typical uses
Method	n	Multifactorial aetiology	Between and within-athlete differences	Complex system	Includes time-varying and time-invariant variables	Missing/unbalanced data (due to rep. measures)	Repeated measure dependency	Incorporates time in the analysis	
Repeated measures ANOVA (One- or two-way ANOVA allowing for between- and within)	5	O	O	X	O	X	√	√	Killen used 1-way ANOVA to compare the load in early pre-season compared to late pre-season, and used chi-square analyses to compare injury rate in the early and late pre-season. Uses the two separate analyses to tentatively link load leads to injury. Gabbett, 2004 performed a 2-way ANOVA comparing loads (season X month), so time is included.
Ehrman - 2016 Gabbett - 2004 Malisoux - 2013 Murray - 2016 Killen - 2011		Murray (2016) compared part of season by training load group, Malisoux (2013) and Ehrmann (2016) only compared injury and pre-injury blocks	In some cases (Murray, 2016), a two-way repeated measures ANOVA can examine between and within athlete differences in risk	No interactions between multiple predictors	Murray (2013) compared load group by season period	Assume sphericity	Yes, by definition	Yes, as season period, or as pre-injury and injury period	
Cox proportional hazards model	1	√	X	X	X	√	√	√	
Malisoux - 2013		Included volume and intensity of training along with age and sex	Cox PH conducted at the team/school level examined between-athlete differences	No interactions between factors	Only included average weekly load and average intensity	Can handle unbalanced data	By using time-to-event as the outcome, Cox-PH robust to this dependency	Uses time to event in analysis	

		Themes of theoretical model			Themes of temporal design: intensive longitudinal data				Statistical summary and typical uses
Method	n	Multifactorial aetiology	Between and within-athlete differences	Complex system	Includes time-varying and time-invariant variables	Missing/unbalanced data (due to rep. measures)	Repeated measure dependency	Incorporates time in the analysis	
Generalised estimating equations (modeled through logistic and poisson regression)	6	O	X	X	O	√	√	O	Most GEE approaches accounted for repeated measures, but Clausen et al (2014) used them to cluster players within teams), averaging exposure throughout the entire season.
Clausen - 2014 Cross - 2016 Dennis - 2004 Gabbett - 2010 Gabbett Domrow - 2007 Veugeleurs - 2016		Most authors used multiple variables with GEEs, although some only used GEE to account for repeated measures (Dennis, 2004, Gabbett Domrow, 2007)	Provides an 'average' effect for all athletes, but controls for the clustering	No complex interactions between factors	Some authors only predicted injury (y/n) based on workload variables	GEEs handle unbalanced data well	GEE accounts for clustering	Do not incorporate time explicitly into the modelling process, and none of the authors included time in the model.	
Multilevel Modeling	1	√	√	X	√	√	√	X	
Windt et al - 2016		Multiple physical outputs included and pre-season training	Within-athlete risks determined from level 1 variables, between-athlete from level 2	No complex interactions between factors	Pre-season and player variables along with training variables	Multilevel models are robust to missing/unbalanced data	Via random effects for each player	Analysed weekly risk and subsequent week risk; did not directly incorporate time	
Frailty model	1	√	√	X	√	√	√	√	Included a many physical output metrics that were dichotomised into high/low categories and calculated RRs. Multicollinearity was not considered
Gabbett Ullah - 2012		Yes, previous injury and physical outputs	Unclear (I think yes due to the frailty term)	No complex interactions between factors	Yes (injury history)	Yes (robust to unbalanced data)	Yes (frailty model allows for dependency of recurrent events)	Yes, since this is a time-to-event analysis.	