

## Abstract

Title: Running-related injuries among recreational runners

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It is important for improving and maintaining general health to engage in regular physical activity. A major barrier to retain in regular physical activity is quitting because of an injury. In running, one of the most practiced leisure-time physical activities on a global scale, injuries are unfortunately common. Numerous studies have described different measures of prevalence and incidence of running-related injuries, in different cohorts, such as novice runners, recreational runners or elite runners. The annual injury incidence proportion, for example, varies in the literature between 18 and 94 percent. This large variation might be explained by differences in injury definitions and study designs. The lower numbers however, might also result from studies with a relatively high proportion of dropouts, runners that leave the study during follow-up, which is not always considered in calculations of injury incidence proportions. Moreover, many studies have aimed to explore predictive factors for running-related injuries using a relative measure of association, such as relative risk or odds ratio. The information provided from such studies might be less usable for practitioners (coaches and clinicians), than information from studies using absolute measures of association, such as risk difference. Last, there is a need of more research that consider changes in training load as the main exposure.

This thesis focuses on running-related injuries, a common obstacle for persistent running among recreational runners. The overall aim is to describe *how many* runners that sustain injury over a given time, predict *who* or which type of runner that sustain more injuries compared with runners having other characteristics, and to investigate if changes in training load can explain *why* injuries occur. More specific, the purpose was 1) to accurately describe the annual cumulative incidence proportion and the most common anatomical locations of running-related injuries, 2) to explore the associations between baseline characteristics and running-related injuries, using both relative and absolute measures of association and 3) to explore changes in training load and running-related injuries using effect-measure modification.

The material for this compilation thesis include four published or accepted papers, one paper currently in manuscript format and a thesis frame. All papers are based on data from a prospective cohort study named SPRING. In addition, paper II includes data from three other prospective cohort studies. The procedure is described in detail in a study protocol (paper I in the thesis). SPRING included more than 220 injury-free male and female recreational runners between the ages 18-55, recruited from Gothenburg Half Marathon. The runners underwent a baseline examination consisting of tests for passive range of motion, isometric strength and running style. Afterwards the runners submitted their training information (including distance, time, intensity) on a weekly basis for a time period of one year, or until they were injured or censored (leaving the study due to other reasons than injury). A sports medicine doctor diagnosed injured runners, and injuries were then grouped into foot/ankle, Achilles tendon/calf, lower leg, knee, thigh, hip/pelvis and lumbar region. The follow-up included training data from more than 17 000 running sessions, from all participants.

Paper II highlights the difference between the cumulative incidence proportion calculated with and without censoring across four studies. In SPRING, the difference was 13%-points, from 33% without censoring to 46% with censoring. Paper III presents the most common anatomical locations, which was the knee (accounted for 27% of all injuries) and Achilles tendon/calf (25% of all injuries). Moreover, runners with a previous injury was almost twice as likely to sustain a running-related injury as runners with no previous injury ( $HR= 1.9$ ). In paper IV, we investigated if runners with certain characteristics (with regard to range of motion, strength and running style) sustain more injuries than runners having other characteristics. The data from this study suggest no associations at all between excessive or restricted joint range of motion, excessive or restricted muscle flexibility or having painful trigger points, and running-related injury. However, we could identify that runners having late timing of maximal eversion or low ratio between hip abductors and hip adductors (i.e. relatively weak hip abductors) sustained more injuries compared with runners in the corresponding reference group. Runners and coaches can use this information in the planning of the running training.