Take home message

Resistance training induces larger increases in skeletal muscle mass than in fat free mass. Muscle hypertrophy does not occur uniformly throughout each individual muscle or region of the body.

after RT. In our study, there were no differences in total body water (bioelectrical impedance analysis method) after training (63.6–69.3% before v 63.4–67.5% after). One possible explanation is that non-SM lean tissue may decrease after RT. Clearly, more work is needed to determine if there are changes in organ or non-SM lean tissue after RT.

If changes in muscle hypertrophy were constant across every muscle, then a single anatomical CSA would reflect changes in SM mass. However, our data show that muscle hypertrophy did not occur uniformly throughout each individual muscle or region—for example, trunk, arm, and leg—of the body. Therefore the distribution of muscle hypertrophy and SM mass are important for evaluating the effects of total body RT because there are differences between relative changes in individual muscle CSA and SM mass.

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How valid is a self reported 12 month sports injury history?

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Background: A past injury history is one of the most commonly cited risk factors for sports injury. Often, injury history data are collected by self report surveys, with the potential for recall bias.

Objective: To assess the accuracy of a 12 month injury history recall in a population of 70 community level Australian football players.

Methods: The retrospective, self reported injury histories of 70 community level Australian football players were compared with prospective injury surveillance records for the same 12 month period. The accuracy of the players' recall of the number of injuries, injured body regions, and injury diagnosis was assessed.

Results: Recall accuracy declined as the level of detail requested increased. All players could recall whether or not they were injured during the previous year. Almost 80% were able to accurately recall the number of injuries and body regions injured, but not the diagnoses, whereas only 61% were able to record the exact number, body region, and diagnosis of each injury sustained.

Discussion: The findings of this study highlight the difficulty of using retrospectively collected injury data for research purposes. Any injury research relying on self reported injury history data to establish the relation between injury history and injury risk should consider the validity of the self report injury histories.

One of the most commonly reported risk factors for sports injury is the presence of a positive past injury history.[1–6] However, often this is based on self reported data, relying on the participants' correct memory of events. This reliance on memory can introduce recall bias,[7 8] potentially leading to incorrect conclusions about the epidemiology of sports injuries sustained and the relation between past and future injury.

The potential for recall bias can be avoided altogether if self reported injury data are avoided. For example, information could be extracted from a participant's medical record or from prior injury surveillance records.[7] However, difficulties arise with respect to accessing medical record data for establishing an injury history. Sports participants can seek treatment from more than one type of health professional and in more than one location, increasing the difficulty of collecting the relevant information. In addition, continuing sports injury surveillance systems using prospective methods are relatively uncommon, particularly in Australia. Prospective studies are often time consuming and can be expensive to undertake because of the length of data collection and the degree of monitoring involved.[9 10] Therefore, studies designed to evaluate the relation between an injury history and a subsequent injury must often rely on self reported data.

Minimisation of recall bias is a prerequisite when the collection of self reported data cannot be avoided.[7] Providing
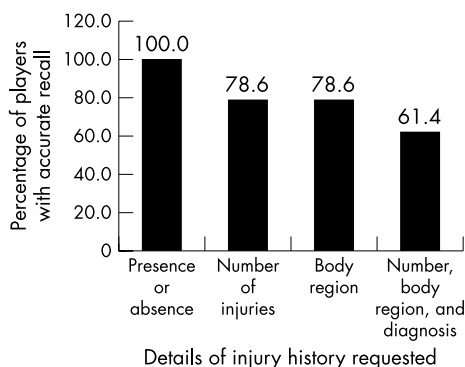
Figure 1 Accuracy of player recall of aspects of a 12 month injury history.

a clear definition of injury can help to improve the memory of participants through the provision of specific prompts. For example, requesting information about injuries resulting in a designated number of missed training sessions or games is likely to result in better recall than simply asking about any pain experienced.[11]

Limiting the length of time over which participants are asked to recall injuries can also help to reduce the impact of recall bias.[12] The longer the time frame, the less likely the injury history is to be accurate. Previous sports injury studies have tended to focus on a 12 month injury history,[2 3 6 13] potentially to ensure that all injuries sustained during the previous season are included. However, the validity of a sports participant's recall of injuries sustained over this time frame has not been well established.

Twellaar et al[14] found that sports participants recalled 61% of their injuries accurately one year later, but the injury definition used was very broad and included "any episode the athlete reported". Whether this injury definition was sufficient to stimulate accurate recall in athletes 12 months after injury is questionable. However, a 39% drop off in injury recall accuracy from two to 12 months has also been shown in a study of work related farming injuries requiring medical treatment.[12]

A study comparing retrospective and prospective injury data from a population of gymnasts found a higher incidence of injuries when data were collected prospectively.[15] However, the comparison data were from two different time periods and therefore the accuracy of the retrospective data could not be established.

This study describes the accuracy of a 12 month self reported injury history in a group of community level Australian football participants.

METHODS
During the 1999 Victorian Amateur Football Association season, 350 football players participated in a prospective injury surveillance study. This study collected information about all football related injuries resulting in missed participation time and/or treatment from a health professional on a standardised data collection form. The club physiotherapist was responsible for injury data collection, and training and match exposure were collected by the coaching staff. The results of this study and the methodology used are published elsewhere.[16] All injuries resulting in missed participation time and/or treatment from a health professional were recorded by the surveillance system prospectively.

In 2000, a prospective cohort study of risk factors for lower limb injuries was undertaken. Eighty five players in this risk

factor study were also participants of the 1999 injury surveillance study.

Players participating in the 2000 study were required to recall any injuries they sustained during the previous football season—that is, during 1999—that resulted in them missing two or more training sessions and/or one or more games, and/or requiring treatment from a health professional. The number of injuries sustained, body region injured, and the diagnosis of the injuries were requested. The questionnaire was completed just before the start of the competitive season during a club training session in the presence of a data collector. The questionnaire was based on one used previously in a case-control study of risk factors for injury in Australian football[17] and was pilot tested before implementation.

To assess the accuracy of the 12 month self reported injury history, these recall data were compared with the prospectively collected injury surveillance data from the previous season in players that participated in both studies. The comparison was made on only those injuries that met the criterion of the 2000 survey, as the injury surveillance definition was slightly broader during the 1999 surveillance because of the inclusion of all injuries resulting in missed playing time rather than those resulting in two or more missed training sessions and/or one or more missed games. The accuracy of the players' recall of the number of injuries, injured body regions, and injury diagnosis was determined by comparing the self reported injury history with the injury surveillance records from the previous season. The level of agreement between the two was calculated as the proportion of instances in which the two records agreed. Where possible, κ tests were performed to establish the degree of agreement between retrospective and prospective data.[18] The 95% confidence interval (CI) was calculated for κ. χ^2 analysis was used to test for an association between the retrospective recall accuracy of players and the number of injuries recorded prospectively.

RESULTS
Of the 85 players eligible for the comparison, only 70 (82%) completed a baseline risk factor questionnaire and are therefore included in these analyses.

Perfect agreement (κ = 1.00, 95% CI 1.00 to 1.00) was shown between retrospective and prospective records when players were asked whether or not an injury had been sustained during the previous season—that is, yes or no. Fifteen players were not injured in the previous season according to prospective records, and all confirmed this in the retrospective survey.

Figure 1 illustrates the proportion of players who were able to accurately recall the various aspects of their injury history.

Fifty five players (79%) accurately recalled the number of injuries sustained during the previous football season, showing good agreement between retrospective and prospective records (κ = 0.71, 95% CI 0.57 to 0.84). The same number accurately reported the injured body regions. Only 61% of players could accurately recall the injury diagnosis, the number of injuries sustained, and the body regions injured simultaneously.

Fifteen players (21%) could not accurately recall the number of injuries they sustained, let alone the details of these injuries. Of these, four overreported and 11 underreported the number of injuries sustained in the previous year. The number of injuries overreported was four, and the number of injuries underreported was 14. There was a significant association between the accuracy of retrospective recall and the number of injuries recorded prospectively (χ^2_2 = 14.0, p<0.001), with a higher than expected proportion of players who sustained more than one injury

during the 1999 season incorrectly recalling their injury history.

DISCUSSION

The baseline risk factor questionnaire asked players to recall the number, and provide details of, any injury that was serious enough to require treatment and miss considerable amounts of playing time. Despite these wide criteria, the results of this validity study indicate that the 12 month recall of injury details at the community level of football is not entirely accurate.

Players who were not injured had no difficulty in accurately remembering this. However, previously injured players predominantly had difficulty recalling the injury diagnosis, with only 61% able to record all of their injuries in detail. A higher proportion of players were able to recall the number of injuries sustained and the body regions of the injuries.

Overall, players were able to correctly indicate their injury status (injured/uninjured) in the previous 12 months, but as the detail required and the number of injuries necessary to recall increased, the accuracy of their recall declined. Therefore, when using a self reported injury history to assess the relation between past injury and subsequent injury risk, or to establish the pattern of injuries sustained, the implications of this validity study should be considered. Reliance on self reported retrospective injury data for establishing injury patterns is likely to be inaccurate because of the inability of players to describe the number, body region injured, and diagnosis of injuries sustained. A tendency towards underreporting of injuries was also found in this validity study. Hence, self reported retrospective injury data are unlikely to provide a detailed enough description of injury patterns to inform further injury prevention research, although past injury status is reported without error over 12 months.

Comparing the past history of a specific injury with a subsequent injury must be undertaken with caution because of the less accurate recall of injury diagnosis detail and the difficulty in assessing the players' knowledge of their injury diagnoses. Comparison of provisional injury diagnoses from the prospective surveillance study with self reported injury diagnoses was made in this study. Although the provisional diagnoses were made by qualified health professionals, it is possible that these changed with subsequent investigations or clinical assessment. Therefore, whether the discrepancy seen between retrospective recollection and prospective injury records is due to a change in the diagnoses over time or incomplete recall is difficult to assess and must be acknowledged as a limitation of this study. However, the overall findings of this study show that if the injury status (injured or not injured) is just being related to the outcome measure, the findings are likely to be very accurate, but requesting more detail than this will result in a reduction in the validity of the information provided.

The findings of this validity study are consistent with those from previous populations of sporting participants[14] and work related injuries.[12] Community level football players were no more accurate at recalling their recent injury history than other populations despite being asked to recall only injuries meeting very specific criteria.

CONCLUSION

Overall, the findings of this small validity study suggest that community level football players more reliably recall the body region and number of injuries sustained than specific diagnoses of their injuries. Only 61% of players were completely accurate when recalling their 12 month injury history. However, a 100% recall was shown for the past injury status—that is, yes or no. Any injury research relying on self reported injury history data to establish the relation between injury history and injury risk should consider the implications of this validity study.

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