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Maintaining motivation and health among recreational runners: Panel study of factors associated with self-rated performance outcomes at competitions

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ABSTRACT

Objectives: To investigate health-related factors associated with self-rated race performance outcomes among recreational long-distance runners.
Design: Panel study.
Methods: Data were collected from runners one month before and after a community-level race event including distances from 8 to 42.2 km. The primary outcome measure was self-rated race performance outcome. The explanatory variables represented health complaints suffered during the build-up year, the pre-race month, and the race and among full marathon runners predicted objective performance outcome (mean pace equal to training pace or faster). Multiple logistic regression was used to determine factors associated with the self-rated performance outcome.
Results: Two-hundred forty-five runners (29%) provided complete data sets. Seventy-four percent of the runners reached their desired race performance outcome. Achievement of the performance outcome was more likely when having avoided illness during the build-up and pre-race periods (OR = 3.8; 95% CI:1.8–8.0, $p < 0.001$), having avoided per-race injury (OR=3.0; 95% CI:1.2–7.4, $p = 0.02$) and avoided per-race illness (OR = 4.1; 95% CI:1.3–15, $p = 0.020$). Having obtained the self-rated performance outcome was also associated with running a shorter distance (OR=3.6; 95% CI: 1.7–8.0, $p = 0.001$) and being younger than 50 years of age (OR = 2.4; 95% CI:1.1–5.3–8.3, $p = 0.03$). Having met the predicted objective performance outcome predisposed marathon runners to also obtain the self-rated performance outcome (OR = 4.7, 95% CI: 1.5–16, $p < 0.01$).
Conclusions: Having avoided illness during build-up and pre-race was positively associated with self-rated race performance outcome among recreational runners. Adjusting the desired performance outcomes with regard to recent illness and age may help recreational runners to more often achieve their goals and thereby prevent them from leaving the sport.

1. Practical implications

- Recreational runners should carefully consider participation or adjust their goals[12] in running races when having been long-term (>3 weeks) ill during the 12-months period prior the race.
- If recently having been ill, consult a physician before participation.
- Runners should perform a training session at close to competition pace before the race (1–2 weeks before) to evaluate their fitness and set their performance goals accordingly.[12]
- Older runner should continuously adjust their desired performance outcomes with regard to their physical capacity.

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2. Introduction

Running is one of the most popular forms of exercise worldwide.[1] Regular recreational running has been associated with numerous beneficial effects on health and lifestyle, ranging from improved cardio-respiratory fitness, to longevity and enhanced mental health.[2] Knowledge of factors that support maintained participation in the sport is therefore important from a health promotion perspective. Running-related injuries constitute a well-known reason for disrupted participation in running at all levels,[3,4] while interaction with illness mainly has been studied among competitive athletes and with regard to cardiovascular risks at races.[5,6] Moreover, for many recreational runners, participation in competitions is a vital motivational factor for upholding the exercise habit. According to self-determination theory, both intrinsic factors, such as enjoyment and challenge to participate, and extrinsic factors, such as social rewards and expected health-related outcomes contribute to runners' willingness to participate in competitions.[7] This implies that factors associated with performance outcomes at races are of interest when considering maintained participation in recreational running.

In elite athletes, evaluations of performance outcomes are normally objective by nature and use crude measurements based on physical (in comparison to psychological) achievements such as time, height or distance in competitions.[8] These objective approaches may be less useful for evaluations of competition outcomes in settings where personal development is emphasized, e.g. among young athletes.[9] For such formative evaluations, Raysmith and Drew[10] recorded Athletics athletes' subjective performance goals before the pre-season and evaluated these goals in a post-season review. By relating to the athlete's current ability and personal ambitions, the evaluations were aligned with the athletes' internal motivations and career plans. Regarding objective measures of recreational runners' race performance outcomes, the runner's physical achievement at the race can be estimated using self-reference,[8] e.g. by comparing the average running speed during the race to the runner's regular running speed during training. However, for recreational runners, using their self-ratings for race evaluations appears as an approach with higher relevance. Recreational runners' objectives may be related to just finishing the race, finishing position, or just to "feel good" during the race.[11] Here individual goals may be moderated by integration with collective goals, such as within running teams, where goals are negotiated and agreed upon between the team members.[12]

The aim of this study was to investigate pre- and per-participation health-related factors in recreational long-distance runners and how these factors are associated with self-rated race performance outcomes.

3. Methods

A panel study design was employed with data collection using smartphone surveys (Briteback TM) before and after a community-level running competition. The running competition was local and not included in any race series. No prize money was awarded. The primary outcome measure was the runner's self-assessment of having reached the desired performance outcome or not. The explanatory measures were sociodemographic factors, pre-participation health, a predicted objective performance outcome (full marathon runners), and running background. Regulation of pace and exercise intensity in competition and in training is a complex interaction between physiological and psychological factors that also are related to the experienced performance.[13,14] Prediction of the objective performance outcome was therefore based on intra-individual comparison with the runner's own habitual training pace. The study design was approved by the local research ethics board in Linköping (Dnr 2015/163-31) and conducted in accordance with the ethical principles of the Declaration of Helsinki.

The study population consisted of runners registered for a race at a marathon course of in Sweden in September 2015. The course was relatively flat and of standard-length (42.2 km). 833 runners were eligible; 341 were full marathon runners, while 492 runners participated in a marathon relay where 4 runners ran distances between 8 and 12 km to complete the same course. Two-hundred forty-five (29%) runners provided complete data sets, 136 marathon runners (40%) and 109 relay runners (22%). The median age was 41 years (range 21–69 years) in the marathon group and 38 years (range 19–63 years) in the relay group. The median number of marathon races completed among the starting marathon runners was 1 (range 0–298), and 40% were first-time participants. The median average training distance was 30 km/week (range 0–100 km/week) and the median pace was 5.00–5.30 min/km in a long-distance training run for the marathon runners.

A baseline survey was sent out per e-mail one month before the race asking for information about demographic characteristics, lifestyle factors and running-related background including training load (average running distance, average running time, and average time spent for alternative training, per week for the last 3 months). Information was also obtained about self-reported injuries or illness in the previous 12 months (the race build-up period) forcing the runner to reduce exercise for more than 3 consecutive weeks. A follow-up survey was distributed after the race, asking for information whether injuries and illnesses occurred during the final 4 weeks before the race (the pre-race period) forcing the runner to reduce exercise for more than 3 consecutive days. The follow-up survey also asked for health problems during the race (per-race health). Injuries were divided into those sustained acutely in a discrete event due to exposure to force, and those related to overuse with gradual onset. For the build-up and pre-race periods, gastrointestinal and respiratory tract infections, other respiratory and gastrointestinal problems were asked for. For the race, questions on hyperthermia and dehydration were added. Finally, the follow-up survey asked for information on achievement of performance goals, i.e. the runner's self-rating of whether the race performance was better than expected, as expected, or worse than expected.

Descriptive statistics on the proportion of athletes with injury and illness complaints were compiled for the pre-race year, the pre-race month and the race. For injuries or pain, the proportion sustained acutely in a discrete event and also the pain locations were presented for all time periods. For illness, the type of problems was presented for all time periods.

Logistic regression models were fitted to test which factors were associated with reaching the self-rated performance outcomes. The following categorical data were used for the explanatory variables: type of event (marathon/relay), sex, age ($<50/\geq 50$ years), four variables measuring injury complaints and illness complaints respectively (yes/no): (a) 12 month before the race, (b) 4 weeks before the race, (c) during the race, and (d) combined 12 months and 4 weeks data. The following numerical data were chosen from the survey: number of marathon runs performed and km/week average training distance. Each factor was tested in univariate logistic regression models, and thereafter in a multiple logistic regression model using backward elimination of non-significant factors (using a significance level of 5%). In the multiple model, persons with missing values on any of the included variables were excluded. The same analysis procedure was repeated separately for the full marathon runners, but with the addition of a binary objective performance outcome variable. This variable was constructed based on whether the runner's average race pace was (a) better or equal to their habitual training pace or (b) lower than their habitual pace.

Table 1
Injury and illness during build-up year[a] and pre-race month[b] (n = 245).

	Race build-up	Pre-race
Injury complaint suffered n (%)	100 (41)	56 (23)
Traumatic injury n (%)	14 (14)	8 (15)
Overuse injury, sudden onset n (%)	37 (37)	19 (34)
Overuse injury, gradual onset n (%)	49 (49)	29 (51)
Pain locations (n)		
Groin	5	3
Thigh	12	6
Knee	37	13
Lower leg (frontal or side)	9	0
Calf	12	12
Achilles tendon	19	5
Ankle joint	6	5
Foot	16	9
Toes	4	4
Hip (laternal or back)	20	0
Spine	9	2
Other	0	1
Illness complaint suffered n (%)	49 (20)	51 (21)
Respiratory tract infection (n)	24	21
Gastrointestinal infection (n)	3	2
Other (n)	22	28

[a] Abstained training due to injury or pain for more than 3 weeks.
[b] Abstained training due to injury or pain for more than 3 days.

Table 2
Injury and illness complaints during the race (n = 224).

	n (%)
Injury complaint suffered (n = 223)	32 (14)
Traumatic	3 (11)
Overuse injury, sudden onset	9 (27)
Overuse injury, gradual onset	20 (62)
Injury/pain locations	
Groin	3
Thigh	5
Knee	9
Lower leg (frontal or side)	0
Calf	5
Achilles tendon	3
Ankle joint	2
Foot	3
Toes	3
Hip (lateral or back)	0
Spine	2
Other	0
New injury/pain at race	28
Postrace medical consultation (physician, nurse, chiropractor) (n)	0
Illness complaint suffered (n = 209)	16 (8)
Respiratory tract infection	6
Gastrointestinal infection	4
Other (incl. dehydration)	6

4. Results

Having sustained a prolonged injury episode during the build-up to the race was reported by 41% of the runners (Table 1). Eighty-six percent of these episodes were reported to have been associated with sports overuse injury. The most common anatomical location was the knee. Having suffered a prolonged illness episode during the build-up to the race was reported by 20% of the runners. The predominant illness type was respiratory tract infection.

Twenty-three percent of the runners had suffered a pre-race injury episode (Table 1). Fifteen percent of the runners had sustained injuries both during the build-up and pre-race periods. Twenty-one percent of the runners reported having suffered a pre-race illness episode. Seven percent of the runners had sustained illness episodes both during the build-up and pre-race periods. Nine runners (4%) reported non-musculoskeletal chronic diseases such as diabetes. No runner had visited a physician as a part of the preparation to the race.

Twenty-one respondents (14 marathon and 7 relay runners) did not start the race; the 224 race participants comprised 122 marathon runners (26% females) and 102 relay runners (59% females). Fourteen percent of the race participants reported that their race performance was constrained by an injury (Table 2). Eight percent of the runners stated that their race performance was constrained by an illness-related health problem. No runner sought professional medical help directly post-race.

Eighty-one percent of the 224 runners reached their self-rated performance outcome. According to the multiple model including all runners (Table 3), reaching the performance outcome was more likely when not having suffered any illness during the build-up or pre-race periods (OR = 3.8; 95% CI:1.8–8.0, $p < 0.001$), having avoided per-race injury (OR = 3.0; 95% CI:1.2–7.4, $p = 0.02$) and per-race illness (OR = 4.1; 95% CI: 1.3–15, $p = 0.020$). Reaching the desired performance outcome was also associated with running a shorter relay distance (OR = 3.6; 95% CI: 1.7–8.0, $p = 0.001$)) and being younger than 50 years of age (OR = 2.4, 95% CI: 1.1–5.3–8.3, $p = 0.03$) (Table 3; Supplemental Fig. F1).

Fifty-seven percent of the marathon runners were able to complete the race at their regular training pace or faster. The multiple model including only full marathon runners (n = 103) showed that runners having reached the objectively predicted performance outcome were more likely to report a positive self-rated performance outcome (OR = 4.7, 95% CI: 1.5–16, $p < 0.01$) (Table 3). Not having sustained per-race injury (OR = 8.1, 95% CI: 2.3–32; p < 0.001) or per-race illness (OR = 28, 95% CI: 3.7–630; p < 0.01) were also associated the self-rated performance outcome as well as being of younger age (<50 years) (OR = 4.9, 95% CI:1.3–20; p = 0.02). There was a tendency towards that runners not having suffered illness complaints during build-up and pre-race were more likely to report a positive self-rated performance outcome (OR = 3.5, 95% CI: 1.0–13.3; p = 0.06).

5. Discussion

Although there is a plethora of studies on risk factors for injuries among recreational runners, few studies have addressed how pre-participation health and per-race factors are associated with race performance outcomes.[3] The aim of this study was to investigate pre- and per-participation health-related factors and their associations with the self-rated performance outcome at running competitions. The main findings are that evading illness before the race and avoidance of illness and injury complaints during the race were associated with the self-rated performance outcomes in this broad category of recreational runners. Having met the objectively predicted performance outcome was among the marathon runners positively associated the self-rated race outcome. Somewhat surprisingly, having sustained an injury during the build-up and pre-race periods was not found to be associated with achievement of performance goals.

The observation that illness has a significant negative impact on athletic performance outcomes has previously been reported from studies among international elite endurance athletes,[5,15] Athletics athletes,[10] and competitive runners.[6] In this study of recreational runners, we found associations between evading illness during the build-up to the race and reaching the desired performance outcome at the competition. These findings suggest that when recreational runners are held back from training by an infection for a prolonged period during the build-up to the race, adaptations of goals or abstaining from participation could be considered. Acute febrile illness has a multitude of detrimental effects[16] and full recovery may require several weeks.[17] The build-up for the race was 12 months in this study as defined in the questionnaire. However, an illness 10–12 months before the race might be less important than an illness in the last 4–2 months before. Nonetheless, when the main

Table 3
Associations between reaching self-rated race performance outcomes and sociodemographic factors, pre-participation health, predicted objective performance outcome, and running background among recreational runners (multiple logistic regression models).

	All runners (n = 221)		Marathon runners (n = 103)	
	Multiple model		Multiple model	
	OR (95% CI)	*p*	OR (95% CI)	*p*
Race distance			NA	
Marathon (ref)	1.0		–	
10 K (8–12 k)	3.6 (1.7–8.0)	**<0.001**	–	
Predicted objective performance outcome	NA			
Not reached (ref)	–		1.0	
Reached	–		4.7 (1.5–16)	**<0.01**
Age				
50+ years (ref)	1.0		1.0	
<50 years	2.4 (1.1–5.3)	**0.03**	4.9 (1.3–20)	**0.02**
Injury complaints per-race				
Yes (ref)	1.0		1.0	
No	3.0 (1.2–7.4)	**0.02**	8.1 (2.3–32)	**<0.001**
Illness complaints per-race				
Yes (ref)	1.0		1.0	
No	4.1 (1.3–15)	**0.02**	28 (3.7–630)	**<0.01**
Illness complaints during build-up				
Either build-up or 4 weeks before race (ref)	1.0		1.0	
Both build-up and 4 weeks before race	1.0 (0.3–3.6)			n.s.
No illness complaints	3.8 (1.8–8.1)	**<0.001**		n.s.*

OR, odds ratio; CI, confidence interval; bold, significant. *OR = 3.5, 95% CI: 1.0–13.3; $p = 0.06$, at final elimination step. Variables not included in the final multiple models: Sex, injury/pain during build-up and pre-race periods, number of marathons completed, average training distance (km/week).

outcome is personal goal achievement,[18] the most important matter may be whether runners adapt their goals after the illness or not, and not the strength by which the illness actually affects performance, These observations highlight the importance of avoiding infections during the race build-up period also among recreational runners.[6]

When Raysmith and Drew[10] recorded personal performance goals among elite athletes, they related the future competition performance to the athlete's current ability and individual goals. By that approach, the evaluations were aligned with the athletes' internal motivations and plans. Motivational patterns and goal setting may vary considerably also among recreational runners, e.g. with experience and age.[11] In this study, the recreational runners were asked to assess their race performance outcome with regard to their personal goals in an overall assessment. One reason that injuries sustained during the build-up and pre-race periods were not associated with reaching the self-rated performance outcomes may thereby be that injuries in some meaning were seen as recurring teething troubles and thus anticipated by the runners. Illnesses, however, were unanticipated or neglected reductions of physical capacity. In other words, although injuries from a biomedical perspective may reduce the runners' physical capacity as much as illnesses, the injuries may have been regarded as 'unavoidable hazards' and thus included in planning and setting of goals. There may thus be a mismatch between factual influences on recreational runners' health and physical capacity and the runner's beliefs about prevention. Saragiotto et al.[19] described that runners chiefly try to reduce injury risks by changing between different types of shoes and stretching. Therefore, due to that the scientific evidence on causes of injury among recreational runners is incomplete, known contributing mechanisms being steep progression of workload[20,21] and previous injury,[22] it may be even more important to avoid infections than injuries when it comes to adapt goals related to performance outcomes at long distance running event.

Younger runners were found to be more satisfied with their performance. Peak endurance performance has been reported to be maintained until 35 years of age, followed by a modest decrease until 50–60 years of age, and then a progressively steeper decline.[23] This could be a reason for that men aged older than 50 years, hypothetically trusting that their physical capacity was the same as, say, 10 years ago, were found to be disappointed with their performance outcome. A readjustment of desired performance outcomes can mitigate race participants' self-definitions of failure through obtaining satisfaction with smaller accomplishments.[24] Also, relay runners competing at shorter distances were in this study found to be more satisfied with their performance. Maybe less can go wrong during a short race compared to a full marathon, leading to that planning may have been more realistic. However, the completion of a full marathon might be a more challenging goal and therefore leading (if achieved) to greater satisfaction. This may explain the difference in reaching the self-rated performance outcomes between the marathon and relay runners. The goal setting may be more or less challenging and difficult.[12] This implies that runners might benefit from not focusing their participation in running competitions on expectations about performance per se, or, alternatively, to choose running a shorter distance.

Four percent of the runners reported suffering from non-musculoskeletal chronic diseases such as diabetes, but no runner had visited a physician as a part of their race preparation. There also were clinical professionals available at the finish area, but no runners participating sought medical consultation directly after the race or during the initial post-race period. Previous studies have mainly focused on the risk of catastrophic cardiovascular illness.[25] Pre-race screening instruments, such as the ePAR-Q+,[26] have also been developed and have showed promising preventive results.[27] These interventions have focused on prevention of catastrophic illness episodes, and not on maintaining recreational runners' race performance. The results of this study indicate that recreational runners having had their build-up to the race disturbed by illness would benefit from consulting a medical professional pre-race. Apart from risk assessments, runners could be provided information about their medical status that could support them to adjust their race performance expectations to a realistic level.

A strength of this study of recreational runners is the longitudinal panel design considering factors including running-related background, injuries but also illnesses. Also, the time for the winner to complete the marathon course was 2.49.25, implying that the race participants can be considered to have been recreational runners. The limitations of the study comprise comparatively low numbers of participants in the race and a moderate survey response

rate. Also, it has to be taken into regard that the performance evaluations were made retrospectively after the race, leaving open for post-hoc explanations. Runners may have differed in the type of objective they set for the event on a more detailed level as we retrospectively assessed the performance on an overall level in this study. Moreover, the validity of injury self-reporting among recreational runners has been found suboptimal regarding injury types, but satisfactory with regard to anatomical allocation of injury,[28] as used in this study. The possibility of recall bias must also be considered, since the runners were asked to report 12-months retrospective health data in the first, baseline, questionnaire.

In conclusion, to support sustained participation in recreational running, knowledge of factors associated with attainment of desired race performance outcomes is important. The results of this study suggest that also for recreational athletes, illness may be more troublesome to manage with regard to performance outcomes than injury.[10,15] Runners should thus besides injuries, which they normally may attend to on a daily basis, also take illness and their general well-being into consideration. Adjusting the desired performance outcomes with regard to recent illness and age may help recreational runners to more often achieve their goals and thereby prevent them from leaving the sport.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jsams.2019.07.004.

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