VU Research Portal

On the importance of planned health education: Prevention of ski injury as an example

Kok, G.; Bouter, L.M.

published in

American Journal Sports Medicine
1990

DOI (link to publisher)

[10.1177/036354659001800608](https://doi.org/10.1177/036354659001800608)

document version

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

citation for published version (APA)

Kok, G., & Bouter, L. M. (1990). On the importance of planned health education: Prevention of ski injury as an example. *American Journal Sports Medicine*, 18(6), 600-605. <https://doi.org/10.1177/036354659001800608>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

E-mail address:

vuresearchportal.ub@vu.nl

On the importance of planned health education

Prevention of ski injury as an example

GERJO KOK,*† PhD, AND LEX M. BOUTER,‡ PhD

*From the * Department of Health Education and the ‡ Department of Epidemiology and Health Care Research, University of Limburg, the Netherlands*

ABSTRACT

The planning of health education aimed at preventing sports injuries is often incomplete and not stated explicitly. In most instances, the evaluation is incomplete or nonexistent. We present a theoretical framework for planning and evaluating health education, illustrating the main points by using as an example the health education for downhill skiers. Systematic planning consists of analyzing the magnitude of the problem and the behavioral risk factors, studying behavior determinants, designing an optimal intervention, and implementing the intervention. The evaluation phase deals with the effects on these five levels (implementation, intervention, determinants, behavior, and incidence of injury). Some common pitfalls are mentioned and special attention is given to the study of determinants of behavior and to the design of the intervention. The importance of pretesting health education material and the community approach in educating sports participants is underlined. Health education, together with regulations and facilities, constitutes the health promotion strategy in the prevention of sports injuries. For most sports, there seems to be a strong need for further research on the etiology and determinants of behavior before effective prevention can be realized.

Although most people agree that participation in recreational sports is conducive to good health, negative consequences in the form of sports injuries do exist. Data available on the incidence of sports injuries indicate that the problem is substantial in terms of morbidity, medical consumption,

and absence from work and sports.¹⁵ Prevention is usually advocated as a solution, often in the form of health education. The planning of health education activities is often incomplete and not stated explicitly. In most instances, the evaluation is executed only partially or is nonexistent.

Our central thesis is that the effectiveness of a health education intervention is determined by the quality of planning.^{10,17} A thorough evaluation of the health education intervention is necessary for establishing effectiveness. In this study, we illustrate the theoretical considerations involved in planning and evaluating health education to prevent sports injuries by the example of a preventive ski injury program. First, an overview of the phases of the process is presented, in addition to which several common pitfalls are mentioned. Second, special attention is given to the study of the behavior determinants and to the design of behavioral intervention. Third, the role of health education within a strategy for health promotion is clarified. Fourth, a number of conclusions are drawn and some priorities for future research are suggested.

PLANNING HEALTH EDUCATION

A model for the explicit planning and evaluation of health education is presented in Figure 1. Five related steps are involved for both planning and evaluation. These ten steps involve central questions that are presented below and (partially) answered for health education among downhill skiers.

Step 1: How serious is the problem?

Most authors agree upon an incidence of two to four medically treated ski injuries per 1000 skier days.^{1,2,9,12} About 50% of these are considered to be lower extremity equipment-related injuries.^{4,13} This means that this subgroup of injuries is attributed to the failure of the ski bindings to release in time.

† Address correspondence and reprint requests to: Gerjo Kok, PhD, Department of Health Education, University of Limburg, P.O. Box 616, 6200 MD Maastricht, the Netherlands.

Step 2: What behavior is involved?

An abundance of putative behavioral risk factors for ski injury have been mentioned.^{1,2,9} However, studies adequately establishing and quantifying the etiologic role of these factors are very sparse. Although it is probable that not all lower extremity equipment-related injuries can be prevented by optimally adjusting the ski bindings, it appears that lower extremity equipment-related injury rates can be lowered substantially by promoting proper binding adjustment procedures.⁴ Ski bindings adjusted far above the recommended setting are very common, especially among skiers with lower extremity equipment-related injuries.^{9,12,13} A recent German preventive trial shows that readjustment by an expert can substantially lower the incidence of lower extremity equipment-related injuries, indeed, by a factor of three.¹¹

Step 3: What are the determinants of the behavior?

A limited study of the determinants of behavior¹⁹ indicated that one of the most frequently observed skier mistakes is readjusting bindings too high after a fall interpreted by the skier to be caused by inadvertent release. In this study, the belief that adequate adjustment can prevent injury and inadvertent release appeared to be an important determinant of the desirable behavior. Furthermore, it turned out that skiers are more likely to have their bindings adjusted adequately in a ski shop, when they think that experts favor taking this action.¹⁹

Step 4: What options are there for change?

Health education intervention might be able to emphasize the opinion of experts on this subject, making clear what the relationship is between suboptimal adjustment and injury risk. The core of the message should be to have ski bindings adjusted every year in a ski shop by an expert with the aid of a test device. Special attention might be given to explaining that adequately adjusted bindings almost never release inadvertently. There are several ways to formulate this message. A recent study⁷ revealed that phrasing the information in a mildly fear-arousing way, emphasizing the seriousness of the injuries and the vulnerability of the skier, was relatively effective for this purpose, compared to a more neutral formulation.

Step 5: How can that be implemented?

The next step is to decide upon the channel and moment of the health education intervention. In the Dutch study mentioned above,⁷ postal delivery of an audio cassette about 1 week before the beginning of the winter sports holiday appeared to be relatively effective compared to brochures and to earlier delivery of the cassette. Members of the target population for this study were recruited at a ski information fair.

Step 6: Has the implementation been carried out as planned?

This step is designed to ensure that the population of skiers defined to be at risk for lower extremity equipment-related injury actually were reached by the health education intervention. It is clear that this is a necessary, although not a sufficient, condition for effectiveness.

Step 7: Has the intervention been received as planned?

The central question in this step is whether the skiers understood the message contained in the health education intervention. Failure to make fully clear which preventive behavior (adjustment by an expert) is expected to reduce risk can be another source of ineffective prevention of lower extremity equipment-related injury.

Step 8: Have the determinants of the behavior changed?

This phase is concerned with establishing whether the prevalence of the determinants of the desired behavior has risen satisfactorily. In our example, this part of the evaluation should focus on the perceived advantages of adequate adjustment and the perception of the opinion of experts.

Step 9: Has the behavior changed?

Health education aims at modifying behavior. Therefore, quantifying behavioral change is important in the evaluation process. For the skiers, this entails the question of whether the target population engages in optimal binding adjustment more often.

Step 10: Has the problem been lessened?

This is the ultimate measure of efficacy. Steps 6 through 9 can be considered the intermediary steps. In the example given, the postintervention incidence of injury, more specifically of lower extremity equipment-related injury, indicates the overall effectiveness of the health education intervention. For methodologic reasons this straightforward measure is often not presented. Unfortunately, it can be calculated that even a 50% decrease in incidence from 4 to 2 injuries per 1000 skier days fails to reach statistical significance (at $P = 0.05$). This was seen in a study involving 500 skiers, each skiing 10 days, half of them receiving the intervention, the other half studied as controls.¹⁴ This problem is due to

Figure 1. Model of planning and evaluation of health education. (Adapted from Green and Lewis.¹⁰)

the relatively low incidence of the outcome (sports injury) and can be avoided when there is valid and precise knowledge about the relationship between the behavior and the outcome. In these cases, behavioral change can be used as an index of decrease of the sport injury incidence at issue. This will substantially magnify the (statistical) efficiency of the study.

PITFALLS

Unfortunately, the ten steps mentioned above are often not given the appropriate attention. The most common mistake is that people jump from the problem to the intervention without answering the planning questions in between. Furthermore, because evaluation is rare, the ineffectiveness of such interventions remains hidden. Evaluation is necessary for testing previous decisions and for making corrections to improve the intervention. Careful planning can avoid a number of potential pitfalls that we will describe and illustrate once more with the ski injury example.

Pitfall 1

This is the pitfall of developing an intervention for a non-existent problem. In our example, ski injuries are clearly a substantial problem, especially when analyzed in terms of incidence figures and injury severity. However, failure to analyze the problem thoroughly could have led us to develop an intervention for a sport with a very low injury rate or relatively minor injuries.

Pitfall 2

This is the pitfall of developing an intervention addressing behavior lacking a clear relationship with the problem. An example would be a program aimed at reducing levels of alcohol consumption during skiing. In contradiction to popular opinions on this subject, empirical data show that detectable blood and breath levels of alcohol in injured as well as uninjured skiers have a prevalence of only a few percent.^{1,21} There clearly is no need for an intervention. The behavior is not related to the problem. Another example is as follows. Bouter^{1,5} showed that participation in ski gymnastics has no relationship to the injury risk. So, such an intervention can be successful in having a high participation rate without being effective in the sense that no injuries are prevented. This possible pitfall is, in our opinion, currently the predominant threat to effective sports injury prevention. Too often there is a lack of valid knowledge about the behavioral risk factors contributing to the etiology of the problem at issue.¹

Pitfall 3

This is the pitfall of developing an intervention based on a misconceived idea about the behavior determinants. An example would be an educational program on warming up for downhill skiers, based on the idea that people do not

know how to perform the warming up exercises. The majority of the people may know very well how to warm up but refrain from doing these exercises, because, for instance, they consider them to be ineffective or ridiculous. A general finding in health education research is that when a relationship is shown between a health problem and behavior, knowledge about that relation is enough for some people to change their behavior. For a substantial group, however, that knowledge is not enough. We will elaborate on this point below when we describe models dealing with behavior determinants.

Pitfall 4

This is the pitfall of developing the wrong intervention, for instance, an intervention aimed at the wrong group. An example of this would be a school health education program with the message that children ought to wear close-fitting ski boots not made of thermoplastic material.^{1,21} This program would probably be ineffective because usually the parents make the final decisions in buying ski equipment.

Pitfall 5

This is the pitfall of developing a potentially effective intervention with the wrong implementation. For example, suppose facilities for adequate, nonprofit binding adjustment were made available to the subscribers of a ski magazine. The information about this service would probably not reach the majority of beginner skiers, who are generally more accident prone⁵ and often have badly adjusted bindings.^{1,4}

Pitfall 6

This is the pitfall of unjustified satisfaction with the intervention and involves the failure to evaluate the intervention thoroughly. For instance, this error could take the form of satisfaction about the large numbers of brochures on injury prevention handed out to skiers waiting for the ski lifts, with no notice taken of whether the number of injuries had been reduced.

DETERMINANTS OF BEHAVIOR

In general, health educators have to rely on the epidemiologic literature identifying the magnitude of the problem and the behavior that is (causally) involved (Steps 1 and 2, Fig. 1). When such behavior is identified with acceptable certainty, the next step for the health educator is the clarification of its determinants. Figure 2 presents a recently

Figure 2. Model of behavior determinants.

developed model dealing with determinants of behavior.²⁰ This model states that external variables can influence behavior along three different pathways.

1. *Attitude* refers to the knowledge and beliefs of a person concerning the specific consequences of a certain form of behavior. An attitude is the weighing (both conscious and unconscious) of all of the advantages and disadvantages of performance of the behavior, as seen by the individual. Health is only one of the possible considerations, and is often an unimportant one. When health is a part of the attitude, one may suppose that health motivation is a combination of the perceived severity of the health risk, the perceived susceptibility to the health risk, and the effectiveness of the preventive behavior. But again, health considerations are mostly not dominant. Other considerations, such as costs, like or dislike, status, etc., are often more important. For downhill skiers, risky behavior may even have a pleasant, stimulating effect. Skiers appear to have a relatively high sensation seeking score, although predicted differences between injured and uninjured skiers could not be confirmed.³ As said before, knowledge about risks is, for most people, not enough. A painful example is the unhealthy life-style of many doctors.

2. *Social influence* is the influence of others; directly by what others expect, indirectly by what others do (modeling). Social influence is often underestimated as a determinant of behavior. Social psychological studies show that social influence can lead to behavior that conflicts with previous attitudes. Most sport situations are social situations. The basis for social influence lies in two principles: people like to have the right information and the ideas of other people are sources of information, and people like social rewards, such as being complimented by others and belonging to a group. An example of the latter factor would be the often described²¹ situation of beginners taking much too difficult ski runs as a result of persuasion by more advanced members of the same ski party.

3. *Self-efficacy-cum-barriers* stands for the determinant whether one is able to perform the (desirable) behavior. Self-efficacy-cum-barriers involves an estimation of ability, taking into account possible internal or external barriers (e.g., internal: insufficient knowledge, skill, or endurance, etc.; external: resistance from others, time and money not available, conflicting life-style, etc.). Self-efficacy is people's perception of their ability to perform the behavior, and barriers are the real problems they face in actually performing the behavior. Self-efficacy is shaped by experiences with barriers. There is a logical relationship between (perceived) self-efficacy and (real) barriers, but besides that there is also an important relationship between self-efficacy and success in performing the behavior. People with higher self-efficacy have a higher chance of succeeding, independent of the existing barriers. But the discrepancy between (perceived) self-efficacy and (real) barriers should not become too large. Health educators can try to increase the efficacy in order to motivate people to adopt the preventive behavior. At the same time, however, they should help people to overcome

barriers to performing that behavior. An example of a barrier to adequate adjustment of ski bindings is the limited availability of ski shops equipped with an appropriate test device.⁴ Perceived inefficacy among beginning skiers often seems to focus on their inability to control velocity while descending a slope. Taking ski lessons might increase perceived self-efficacy.^{1,5}

We have described in theory the three kinds of behavior determinants, giving examples in the area of ski injuries. To our knowledge, there are no systematic empirical studies on the determinants of desirable and undesirable behavior with respect to most sports injuries. This is clearly an omission in research and a gap that urgently needs filling. Assuming that in the near future this kind of research will be conducted and specific behavior determinants will be known, how do we get from determinants to interventions?

BEHAVIORAL INTERVENTION

Influencing behavior by health education means effecting changes through communication, whether the communication is directed at the people whose health is at risk or at others who influence them. The first goal is to get attention and comprehension. Having achieved this and, consequently, a change in determinants, the third and last goal is to maintain the change in behavior. A once-only change is not enough; the desired behavior should become a habit. The major problem in achieving behavior maintenance is the possible negative experiences people have when performing the desired behavior. Health educators should always be realistic about the experiences after the change to the desired behavior. These experiences, in the short run, are mostly not very positive. Sometimes it is possible to present "organized" positive experiences, for instance, by presenting data about the number of injuries prevented related to the year before.

For the downhill skiers in our example, this would mean informing them of the number of lower extremity equipment-related injuries prevented by the optimal binding adjustment. The best moment for this communication would seem to be shortly before the next winter sports season. The three health education goals shown in Figure 3 are combined

	Source	Message	Channel	Receiver
Attention & comprehension				
Change in attitudes, social influence, self-efficacy cum barriers				
Maintenance of behavior change				

Figure 3. The health education matrix.

with four communication variables in the so-called health education matrix, which is adapted from that devised by McGuire.¹⁸ The cells of this matrix indicate decisions that have to be made, e.g., which source attracts the most attention, which channel is able to change social norms, which group of receivers should be specially prepared for negative experiences, etc. A rich quantity of empirical data can be found in the literature¹⁸ with respect to every possible decision. We will specifically elaborate on two issues here: the need for pretesting and the "community approach" as being the most promising in health educational intervention.

Pretesting of educational materials is meant to check whether the materials have the intended effect on the receivers, especially with respect to attention and comprehension.⁶ It is not enough that all kinds of experts on sports injuries agree that the information in the materials is correct. The next step is to have communication experts judge the materials, and a final step is to try out the materials on a sample of the target group.⁶ Only then is it possible to prevent all kinds of possible unwanted side effects and failed communication. Pretesting is therefore very much needed and should be integrated in the materials development process. To our knowledge, only one study involved explicit pretesting health education material for downhill skiers.⁷

The most promising approach in health education seems to be the community approach, especially with "difficult" issues and "difficult" target groups. Community approaches are characterized by five more or less essential elements.

1. Community approaches are directed at the existing social networks. In the case of sports injuries, these are sports clubs, national sports organizations, or several sports organizations at a local level. The social network is crucial to achieving the educational goals of attention and comprehension, change of determinants, and maintenance of behavior change.

2. Community approaches are multisectoral: they involve health educators, national and local governments, different sports organizations, industry, etc.

3. Community approaches are multimedia activities: mass media can be used as general facilitators, followed by interpersonal communication, local mass communication, and the use of intermediates. Sports injury prevention should be possible by using communication channels that already exist in sports organizations and in the local situation.

4. In the community approach, health is seen as part of a life-style. Programs on sports injury prevention should not deal with sports injuries as an isolated issue, but as being a part of a healthy life-style. This concerns group membership, risk-taking behavior, nutrition, smoking, exercise, etc.

5. Community approaches can be very effective by using paraprofessionals as a source. The basic idea of paraprofessionals entails the training of some relatively influential members of the target group itself to become educators.

Several aspects of this community approach were used in the national Swedish campaign for downhill skiing safety during the 1970s.⁸ This campaign provides a good example

of the evaluation of such a community approach by means of a cost-benefit analysis.

HEALTH PROMOTION

As we have said before, health education is only one possible preventive strategy. Two other possible interventions are providing facilities or regulation. Probably, a combination of the three would be the most effective measure. Health promotion¹⁶ is the integral combination of all possible interventions to achieve health goals: primary prevention, early detection, and patient care. Figure 4 shows the health promotion matrix.

The health promotion matrix provides a framework for health promotion decisions. With respect to health-promoting goals, sports injuries fall primarily under the category of primary prevention. Other health problems may fall under other categories, for instance, breast cancer would be under early detection, asthma under patient care. The latter two problems cannot at present be dealt with in primary prevention. Sports injuries can, provided that sufficient knowledge is available about the causes. In our example, the importance of adequately adjusted ski bindings has been established beyond doubt, so primary prevention can be concentrated on this factor. For nonpreventable injuries, adequate early detection and patient care remains important.

With respect to health-promoting strategies for the prevention of sports injuries, all three options for interventions are available. We can educate, we can provide facilities, and we can regulate. The distinction between these three is not very sharp. On the one hand there is education based on the assumption that people change their behavior when they become motivated, and on the other hand there is regulation based on the assumption that people will change their behavior when they are forced to do so. In the latter situation, control and sanctions are necessary. A combination of both strategies, however, is possible and can be very effective in certain circumstances. This can be illustrated by the development of international conduct rules for skiers and the local education on and enforcement of these rules.²¹ In addition, sanctions by insurance companies might be useful in getting these rules accepted. Facilities are provided, but can be used voluntarily. Education can provide people with information about these facilities. For downhill skiers, for

	Primary prevention	Early detection	Patient care
Education			
Facilities			
Regulation			

Figure 4. The health promotion matrix.

instance, these could consist of facilities for professional binding adjustment. Governments could regulate the provision of such facilities.

Health promotion is integral as well as intersectoral and makes use of an intervention mix. Integral means that health promotion is concerned with health, but also, for instance, with economics. Intersectoral means that health promotion activities involve governmental agencies (departments of health, economics, education) as well as nongovernmental agencies (industry, consumer, and sports organizations). An intervention mix is some combination of regulation, long-term planning, health education, facilities, financial stimulation, and an ongoing evaluation of the effectiveness of that combination. Historically, health education has changed from an isolated educational activity to an essential part of health promotion.

CONCLUSIONS

Determinants of behavior are more than knowledge. There are other attitudinal considerations, there is social influence, and there is the domain of self-efficacy-cum-barriers. Based on these determinants, the intervention should be intersectoral. Health education can be a very important part of health promotion in the case of preventing sports injuries. Pretesting is crucial to developing materials aimed at changing behavior. The community approach is the most promising educational strategy; that is, using the social network, encouraging multisectoral and multimedia approaches, promoting health as a part of a life-style, and using paraprofessionals.

Until now, prevention of sports injuries has been dominated by sports injury specialists. To be effective, these efforts should be combined with health education specialists. With cooperation, it seems possible to achieve a reduction of sports injuries within the next 10 to 20 years. Health education can be an effective way of preventing sports injuries. It is important, however, to realize that the effectiveness of health education (and health promotion) depends on the quality of the planning. That means a careful analysis of the problem, the behavior, the determinants, the intervention, the implementation, and the strength of the relationship among these five aspects. We believe that with respect to the prevention of most sports injuries, we still have not reached the stage where we know exactly what to

advise people. Epidemiologic studies followed by research on the behavior determinants are necessary to fill in the gaps in our knowledge.

REFERENCES

1. Bouter LM: *Injury Risk in Downhill Skiing: Results from an Etiological Case-Control Study conducted among Dutch Skiers*. Haarlem, the Netherlands, De Vrieseborch, 1988
2. Bouter LM, Knipschild PG: Causes and prevention of injury in downhill skiing. *Physician Sportsmed* 17: 80-94, 1989
3. Bouter LM, Knipschild PG, Feij JA, et al: Sensation seeking and injury risk in downhill skiing. *Personality and Individual Differences* 9: 667-673, 1988
4. Bouter LM, Knipschild PG, Volovics A: Binding function in relation to injury risk in downhill skiing. *Am J Sports Med* 17: 226-233, 1989
5. Bouter LM, Knipschild PG, Volovics A: Ability and physical condition in relation to injury risk in downhill skiing, in Johnson RJ, Mote CD, Binet MH (eds): *Skiing Trauma and Safety: Seventh International Symposium*. Philadelphia, ASTM, 1989
6. Damoiseaux V: The necessity of pretesting written information materials. *Internal Report*. Maastricht, University of Limburg, 1988
7. Damoiseaux VMG, de Jongh AML, Bouter LM, et al: Designing effective health education for downhill skiers: Results of a randomized intervention study, in Johnson RJ, Mote CD (eds): *Skiing Trauma and Safety: Eighth International Symposium*. Philadelphia, ASTM, in press, 1990
8. Danielson K, Eriksson E, Jonsson E, et al: Attempts to reduce the incidence of skiing injuries in Sweden, in Johnson RJ, Mote CD (eds): *Skiing Trauma and Safety: Fifth International Symposium*. Philadelphia, ASTM, 1985
9. Eriksson E, Johnson RJ: The etiology of downhill ski injuries. *Exerc Sport Sci Rev* 8: 1-17, 1980
10. Green LW, Lewis FM: *Measurement and Evaluation in Health Education and Health Promotion*. Palo Alto, CA, Mayfield, 1986
11. Hauser W: Experimental prospective skiing injury study, in Johnson RJ, Mote CD, Binet MH (eds): *Skiing Trauma and Safety: Seventh International Symposium*. Philadelphia, ASTM, 1989
12. Hauser W, Gläser H: *Alpine skiunfälle und Verletzungen*. München, DSV, 1985
13. Johnson RJ, Ettlinger CF, Campbell RJ, et al: Trends in skiing injuries. Analysis of a 6-year study (1972-1978). *Am J Sports Med* 8: 106-113, 1980
14. Knipschild PG, Bouter LM: Risk factors for ski injuries: A crash course of epidemiological methods with emphasis on comparability in experiments and case-control studies, in Johnson RJ, Mote CD, Binet MH (eds): *Skiing Trauma and Safety: Seventh International Symposium*. Philadelphia, ASTM, 1989
15. Kraus JF, Conroy C: Mortality and morbidity from injuries in sports and recreation. *Ann Rev Public Health* 5: 183-192, 1984
16. de Leeuw E: *The Sane Revolution; Health Promotion*. Assen, the Netherlands, Van Gorcum, 1989
17. Liedekerken PC, Jonkers R, de Haes WFM, et al: *Effectiveness of Health Education*. Assen, the Netherlands, Van Gorcum, 1990
18. McGuire WJ: Attitudes and attitude change, in Lindsay G, Aronson E (eds): *Handbook of Social Psychology: Volume II*. New York, Guilford, 1985
19. Rosen JC, Johnson RJ, Lefebvre MF, et al: Behavioral determinants of skiers' failure to adjust release bindings. *Clin Sports Med* 1: 209-215, 1982
20. de Vries H, Dijkstra M, Kuhlman P: Self-efficacy: The third factor besides attitude and subjective norm as a predictor of behavioral intentions. *Health Educ Res* 3: 273-282, 1988
21. Ziegler WJ, Jung H, Matter P, et al: *Risikobewust Skifahren*. Derendingen, Habegger Verlag, 1987