HEALTH EDUCATION, A TOOL FOR THE PREVENTION OF DISEASES AND INJURIES
PREVENTION OF SKI INJURY AS AN EXAMPLE

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Firstly, an overview of the several phases of the health education planning process will be presented, in addition to which several common pitfalls are mentioned. Secondly, special attention will be given to the study of the determinants of behavior and to the design of the behavioral intervention. Thirdly, the role of health education within a strategy for health promotion is clarified. Fourthly, a number of conclusions are drawn and some priorities for future research are suggested.

PLANNING HEALTH EDUCATION

A model for explicit planning and evaluation of health education is presented in figure 1. In planning as well as in evaluation five related steps can be discriminated. These ten steps in total can be indicated by their central questions. These questions are presented below and (partially) answered for health education among downhill skiers.

Figure 1. Model of planning and evaluation of health education
(adapted from Green & Lewis, 1986)

Planning

Problem - Behavior - Determinants - Intervention - Implementation

Evaluation

Step 1: How serious is the problem? Most authors agree upon an incidence of 2-4 medically treated ski injuries per 1000 ski person days. 1,4,7,9
Step 2: What behavior is involved? In the literature an abundance of putative behavioral risk factors for ski injury are mentioned. 1,4,7 However, studies adequately establishing and quantifying the etiological role of these factors are very sparse. While probably not all LEER injuries can be prevented by an optimal adjustment of the ski bindings, it certainly appears to be possible to lower LEER injury rates substantially by promoting proper binding adjustment
procedures. Step 3: What are the determinants of the behavior? A limited study of the determinants of behavior indicated that one of the most frequently observed mistakes is that skiers readjust their binding much too high following a fall that the skier interpreted to be due to inadvertent release. In this study the belief that adequate adjustment can prevent injury and can also prevent 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.

Step 4: What options are there for change? Health education intervention could stress the opinion of experts on this subject and make clear what the relation is between suboptimal adjustment and injury risk. The core of the message should be: have your ski bindings adjusted every year in a ski shop by an expert with the aid of a test device. A recent study 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? In the Dutch study mentioned above, postal delivery of an audio cassette about one week before the beginning of the winter sports holiday appeared to be relatively effective compared to brochures and to earlier delivery.

Step 6: Has the implementation been carried out as planned? This step is designed to ensure that the defined population of skiers at risk for LEER injury actually were reached by the health education intervention.

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.

Step 8: Have the determinants of the behavior changed? 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? For the skiers, this entails the question whether the target population engages in optimal binding adjustment more often.

Step 10: Has the problem been lessened? Of course, this is the ultimate measure of efficacy: steps 6-9 can be considered the intermediary steps. In the example the post-intervention incidence of injury, more specifically of LEER injury, will indicate the overall effectiveness of the health education intervention. For methodological reasons this straightforward measure is often not presented, due the relatively low incidence of the outcome (sports injury). This problem can be avoided when there is valid and precise knowledge about the relation
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
magnify the (statistical) efficiency of the study substantially.

PITFALLS
Unfortunately, the ten steps mentioned above are often not given the appropri-
ate attention. The most common mistake is that people jump from the problem to
the intervention without answering the planning questions in between. Further-
more, 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. The development of an intervention for a problem that does not
exist. In our example ski injuries are clearly a substantial problem, especi-
ally when analyzed in terms of incidence figures and severity of the injuries.
However, failure to conduct a thorough problem analysis could have led us to
develop an intervention for a sport with a very low injury figure or relatively
minor injuries.

Pitfall 2. The development of an intervention addressing behavior lacking
a clear relationship with the problem. Bouter showed that participation in
ski gymnastics has no relation to the risk of having an injury. 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
prevention of sports injuries. Too often valid knowledge about the behavioral
risk factors contributing to the etiology of the problem at issue is lacking.

Pitfall 3. The development of an intervention that is based on a
misconceived idea about the determinants of behavior. 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. For the majority of
the people it might be that they know very well how to warm up but they refrain
from doing these exercises, because, for instance, they consider them to be
ineffective or ridiculous.

Pitfall 4. The development of a wrong intervention, for instance an
intervention aimed at the wrong group. An example of this would be school
health education with the message that children ought to wear close-fitting
ski boots not made of thermoplastic material. This could turn out to be
ineffective, because usually the parents make the final decisions in buying
ski equipment.
Pitfall 5. The development of a potentially effective intervention with a wrong implementation. For example, suppose facilities for adequate and non profit binding adjustment were made available to the subscribers to a ski magazine. The information about this service would probably not reach the majority of beginner skiers, who are generally more accident prone and often have badly adjusted bindings.\(^1\),\(^2\)

Pitfall 6. Unjustified satisfaction about the intervention. This concerns the failure to evaluate the intervention thoroughly. For instance, it 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 has been reduced.

DETERMINANTS OF BEHAVIOR

In general, health educators have to rely on the epidemiological literature identifying the magnitude of the problem and the behavior that is (causally) involved (steps 1 and 2 in figure 1). When such behavior is indeed identified with acceptable certainty, the next step for the health educator consists of the clarification of its determinants. Figure 2 presents a recently developed model dealing with determinants of behavior.\(^1^5\) This model states that external variables can influence behavior along three different pathways.

Figure 2. Model of behavior determinants

![Diagram showing the model of behavior determinants with external variables leading to attitude, which influences social influence, self-efficacy, and barriers, ultimately affecting behavior.]

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 the advantages and disadvantages of performance of the behavior, as seen by the individual. Health is only one of the possible considerations, and often an unimportant one. When health is a part of the attitude, we 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 and other considerations like costs, (dis)like, status, etc. are often more important. For downhill skiers risky behavior may even have a pleasant, stimulating effect. As said before, knowledge about risks is for most people not enough. A painful
example is the 'healthful' 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, and 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 to be socially rewarded, like getting compliments from others and belonging to a group. An example of the latter factor would be the often described 16 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 barriers inside or outside the person (e.g. inside: insufficient knowledge, skill, or endurance, etc.; outside: 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, while barriers are the real problems they face in actually behaving. Self-efficacy is shaped by experiences with barriers. There is a logical relation between (perceived) self-efficacy and (real) barriers, but besides that there is also an important relation between self-efficacy and success in performing the behavior. People with a 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. 2 Perceived ineffectiveness 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. 1,3

We have described in theory the three kinds of behavior determinants. We gave examples in the area of ski injuries. To our knowledge there are no systematic empirical studies on the determinants of desired and undesired behavior with respect to most sports injuries. This is clearly an omission in research and the gap needs filling urgently. 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 changing by communication, whether the communication is directed at the people who's health is at risk, or at others who influence them. Therefore the first goal is to get attention and comprehension. Having achieved this and consequently a change in determinants, the third and last goal is the maintenance of a change in behavior. A one-only change is not enough; we want the desired behavior to become a habit. The major problem in achieving maintenance of a change in behavior is the possible negative experiences people have when performing the desired behavior. Health educators should always be realistic about the experiences following the change to the desired behavior. Mostly these experiences are in the short run not very positive. Sometimes it is possible to present 'organised' positive experiences, for instance by presenting data about the number of injuries prevented related to the year before.

For the downhill skiers from our example, this would mean for instance informing them of the number of lower extremity equipment-related (LEER) 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 are in figure 3 combined with four communication variables in the so-called health education matrix adapted from that devised by McGuire. 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. In the literature a rich quantity of empirical data can be found 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.

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<th>Figure 3: The health education matrix</th>
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<tbody>
<tr>
<td>Health education</td>
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<tr>
<td>Attention &amp; Comprehension</td>
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<tr>
<td>Change in attitudes, social influence, efficacy/barriers</td>
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<tr>
<td>Maintenance of behavior change</td>
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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.\textsuperscript{5} 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.\textsuperscript{5} Only then is it possible to prevent all kinds of possible unwanted side effects and failed communication that have not been recognized by the health educators themselves. Pretesting is therefore very much needed and should be integrated in the materials development process.\textsuperscript{5}

The most promising approach in health education seems to be the community approach, especially with 'difficult' issues and with '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 to be found in sport clubs, national sports organizations or several sports organizations at a local level. The social network is crucial to achieving the educational goals: attention and comprehension, change of determinants, maintenance of behavior change.

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

3. Community approaches are multi-media activities: mass media as general facilitators, followed by interpersonal communication, local mass communication and the use of intermediates. Prevention of sports injuries should be possible by making use of communication channels that already exist in sports organizations and in the local situation.

4. Community approaches see health 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 in designing health education for downhill skiers were utilized in the national Swedish campaign for skiing safety during the seventies.\textsuperscript{6} This campaign also 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. Other possible interventions are providing facilities or regulation, and probably a combination of the three is the most effective. Health promotion is the integral combination of all possible interventions to achieve the health goals: primary prevention, early detection and patient care. Figure 4 presents the health promotion matrix.

Figure 4: The health promotion matrix

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<tr>
<th>Primary prevention</th>
<th>Early detection</th>
<th>Patient care</th>
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<tr>
<td>Education</td>
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<tr>
<td>Facilities</td>
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<tr>
<td>Regulation</td>
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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 fall primarily under the other categories, for instance breast cancer 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 adequate adjustment of the ski binding has been established beyond doubt, so primary prevention can concentrate on this factor.

With respect to health promoting strategies in order to prevent 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, but 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. But a combination of both strategies 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. 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 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 non-governmental agencies (industry, consumer 
and sports organizations). An intervention mix is some combination of regula-
tion, long term planning, health education, facilities, financial stimulation, 
and an ongoing evaluation of the effectiveness of that combination. Histori-
cally health education has changed from an isolated educational activity to an 
esential part of health promotion.

CONCLUSION
Determinants of behavior are more than knowledge: there are other attitudinal 
considerations, there is social influence and there is the domain of self-effic-
cacy cum barriers. Based on these determinants the intervention should be 
intersectoral. Health education can be a very important part of health pro-
motion in the case of preventing sports injuries. Pretesting is crucial to 
developing materials that try to change behavior. The community approach is the 
most promising educational strategy: using the social network, multi-sectoral, 
multi-media approaches, 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. In cooperation it seems possible to achieve a reduction 
of sports injuries within the next ten to twenty years. Health education can be 
an effective way of preventing sports injuries. It is important, however, to 
realise 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 of the strength of the relationship between these five aspects. It is our 
opinion that with respect to the prevention of most sports injuries we still 
have not reached the stage that we know exactly what to advise people. Epide-
miological studies on the etiology followed by research on the behavior 
determinants are necessary to fill in the gaps in our knowledge.
REFERENCES


