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An intervention method for occupational safety in farming — evaluation of the effect and process

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Abstract

In order to increase safety in Swedish farming an intervention methodology to influence attitudes and behaviour was tested. Eightyeight farmers and farm workers in nine groups gathered on seven occasions during 1 year. The basic concept was to create socially supportive networks and encourage discussions and reflection, focusing on risk manageability. Six of the groups made structured incident/accident analyses. Three of the latter groups also received information on risks and accident consequences. Effects were evaluated in a pre-post questionnaire using six-graded scales. A significant increase in safety activity and significant reduction in stress and risk acceptance was observed in the total sample. Risk perception and perceived risk manageability did not change. Analysing incidents/accidents, but not receiving information, showed a more positive outcome. Qualitative data indicated good feasibility and that the long duration of the intervention was perceived as necessary. The socially supportive network was reported as beneficial for the change process.

Keywords: Long-term safety intervention; Attitude and behavioural change; Farming

1. Introduction

1.1. Background

Working conditions in agriculture are hazardous. The focus in safety work has mainly been on locating hazards, giving information and providing equipment and methods to reduce or eliminate them (Lundqvist and Gustafsson, 1992). In Sweden, much has been done to promote health and safety in the agricultural sector (Lundqvist, 1996), but the frequency of occupational farming accidents in Sweden is still high (Thelin, 2002; Forsblom et al., 2005).

The most common interventions reported scientifically have been safety education programs (DeRoo and Rautiainen, 2000), but the question has been raised as to whether farmers actually put to use educational information on elimination, reduction and control of physical hazards (Murphy, 1996). The focus of interventions has often been on technical measures, aiming at controlling specific hazards. Many of the risks can be reduced by technical measures, but social and psychological factors hindering or promoting safety activity ought to be further explored. A large intervention program was successfully implemented in Danish agriculture, with methods including attitude-based components of one to one/group strategies (Glasscock et al., 1997, Rasmussen et al., 2003). This intervention included a half-day safety walk-through of each farm and a 1-day safety course. Menckel and Carter (1985) and Sundström-Frisk (1990) reported on successful interventions in other sectors that addressed behavioural change over a longer period using accident/incident reflection. Since farmers often have to develop, plan and solve their safety problems on their own, the support of fellow farmers and arenas for safety development could be beneficial. This indicates that alternative intervention methods ought to be tested and evaluated, with a focus on motivating attitude and behavioural change over a longer time period, to raise the priority of safety activity.

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A comparison of results between studies is often difficult since many interventions have been performed but few have been thoroughly described, either as regards methodology or implementation (Goldenhar and Schulte, 1994). Kristensen (2000) stated that the two main issues in intervention studies are feasibility (is it possible?) and aetiology (does it work?). Many researchers have stressed the need beyond evaluations of effects for process description, qualitative data and evaluation of feasibility (e.g. Shannon et al., 1999; Kristensen, 2000; Goldenhar et al., 2001; Saksvik et al., 2002).

1.2. Theoretical framework for the present intervention

Elkind (1993) stated that implementation should emerge from the needs of the farmer and farm workers and be based on their everyday life and working conditions. Blake and Mouton (1989) suggested that a client's problem could be used as case material. Thus, real examples of incident/accident scenarios may be analysed on the basis of the actions actually taken and of the obstacles to and benefits of different actions. Farmers could be reached and communicated with through a network representing several workplaces. Participating in a network could provide a sense of community and a feeling of shared responsibility for the safety of the group. Oliver et al. (2002) pointed out the importance of social aspects such as establishing norms and a climate of reduced risk acceptance.

In agriculture, work stress has been identified as one of the constraints of work that affects safety (e.g. Kidd et al., 1996). A network could provide the social support to alter the perception of stressors and promote a problem-focused coping strategy (Lazarus and Folkman, 1984). The group setting for gaining new insight into safety has been tested in other contexts (e.g Brosseau et al., 2002; Sundström-Frisk, 1990).

Individual experiential learning (Kolb, 1984) can be understood as an ongoing interchange between action and reflection, where past experiences provide the basis for future ones. Active participation and personal action are prerequisites for the learning process to take place (Döös and Backström, 2003).

Behavioural change is a dynamic process that takes place over time, where people move through a series of stages, as described in the transtheoretical model (TTM) of Prochaska and DiClemente (1982). Thus, conclusions can be drawn that providing sufficient time and support for reflection and restructuring of attitudes and perceptions would facilitate change towards more safety activity. Schein (1987) suggested that a leader of a change process should act as a process consultant who helps participants to find their own solutions, keeps them focused on the subject at hand, and supports a non-judgemental and supportive group climate.

Providing information on risks and their consequences may also be a means to convince participants of the benefits of safety activities. In a study by Eklöf and Törner (2002), perceived risk manageability was positively associated with activity in safety work, thus indicating the need of a focus on manageability. Lazarus and Folkman (1984) concluded that important prerequisites for a problem-focused coping strategy are an insight about the existence of a threat (risk perception) and knowledge about how to handle the threat (risk manageability).

1.3. Aim

The present study encompassed the development and testing of an intervention methodology aiming at stimulating farmers' and farm workers' safety activity by influencing cognitive factors such as risk perception and perceived risk manageability. The intervention was developed and performed in cooperation with the OSH Services of the agricultural sector so that, if found successful, the methodology could easily be carried on and offered to all farmers associated with the OSH Services.

The general aim of the study was to evaluate effects of the intervention methodology, which was based on the theoretical framework presented above. The specific aim was to study differences between pre and post intervention measurements of risk perception, perceived risk manageability, work stress, risk acceptance, safety activity and safety measures undertaken, and to compare and discuss effects of different degrees of structure in the intervention. This structure was provided through analysing incidents and information about risks and accidents. Furthermore, the aim was to describe the process and evaluate the feasibility of the intervention methodology. The basic concept of the intervention was:

1. To create *participative arenas* where farmers and farm workers could exchange experience and find *social support* for increased safety activities.
2. To encourage *new perspectives, discussions* and *reflections* on practise.
3. To facilitate ways of *increasing perceived safety manageability* and stimulate an *action-oriented* way to manage safety.

2. Method

2.1. Intervention design

The intervention was based on discussions in groups with three different degrees of structure. Nine local groups were created and three process leaders were assigned to three groups each. Each process leader by lot assigned his/her three groups to one each of the three different intervention approaches described below. Thus, each process leader was responsible for one group in each approach (see Fig. 1). The reason for doing this was to eliminate the systematic error of process leader

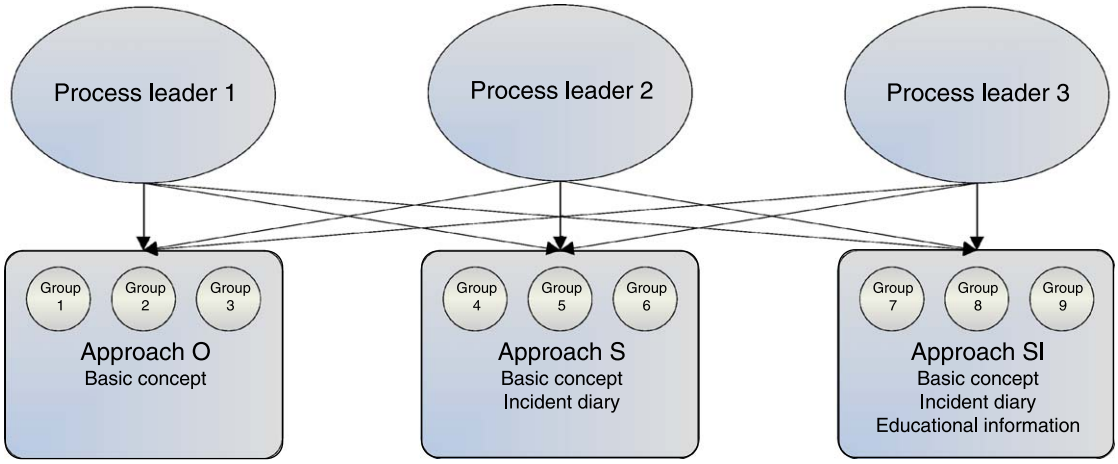

Fig. 1. The intervention design showing the three intervention approaches.

influence when comparing the effects of the approaches. The basic concept described above (1–3) prevailed in all nine groups. The intervention approaches were as follows:

1. Open process approach (O)
   These groups were subjected to the basic concept, an open approach with little structure and control. The task of the process leader was to facilitate and support the participants in expressing their experiences and in reflection, to maintain the focus of the discussion on risks and safety, while avoiding giving expert advice except when this was explicitly asked for.
2. Structured approach (S)
   In these groups the members were in addition given a diary, providing a structure for documenting incidents/accidents, analysing the events upstream (see Appendix A). The purpose was to provide hazardous events, which would be suitable as a starting point for reflection. The goal was to find preconditions for risks, obstacles and facilitators for safety, and patterns in the work environment or in the participants' own actions that could affect safety. These diaries were brought to the meetings as a basis for discussions and reflections. The role of the process leaders was to help participants analyse the events and to stimulate the participants to reflect over their own and fellow farmers' behaviour and possible preventive measures in connection to concrete events.
3. Structure and information approach (SI)
   These groups also used the incident diaries but were in addition given information by the process leader in a more educational way. The purpose was to use this information as a means of raising awareness of risks and their possible negative consequences. Information was given on accident rates in farming, types and effects of accidents, cost analyses of accidents, common attitudes towards risk sources and, finally, general attitudes towards risk and safety among farmers.

2.2. Study design

The study had a quasi-experimental design. The intervention period was from October 2000 to 2001. Over the first 6-month period each group met once a month for 1.5–2 h. The meetings were held after work at either a participant's farm or at a community centre. A final seventh meeting took place 6 months later in October 2001 (see Fig. 2). A baseline questionnaire survey was distributed and completed at the first group meeting and repeated at the final meeting 1 year later.

The present study also includes evaluation of process and feasibility. Process encompasses what happened during the intervention, e.g. development of relations, activity and communication. Feasibility encompasses the factors influencing the possibility to successfully perform the intervention, e.g. time, place, duration and procedures. In accordance with Jerkedal (1990), two perspectives were applied: (1) process analysis, i.e. how the project was implemented and what affected the outcome and (2) a summary of opinions about the project.

2.3. Participants

Nine farmers were recruited from western Sweden, all active in the LRF (the Swedish Farmers' Association). An introductory seminar was held at which the intervention design and procedures were discussed by safety experts and farmers. The nine farmers recruited approximately 10 group members each, with an emphasis on establishing a diversity in terms of production type, gender, age and professional status as employer or employee. The groups were to have been ideally recruited from existing local networks in order to support the safety orientation of these and make support from network members available after the intervention period. The recruiting farmers' role was the convener of meetings. Information about the participants in the different intervention approaches and as a whole is given in Table 1. Initially, 92 participants were

Table 1
Descriptive information on intervention participants per intervention approach and total

	Open group (O)	Structured group (S)	Structured info. group (SI)	Total
Participants at start	31	29	32	92
Participants in final analysis	30	28	26	84
Participants per meeting *M*	23	24	17	64
Men/women	23/7	21/7	22/4	66/18
Employed participants	1	3	1	5
Age *M* (sd)	44.0 (7.8)	43.3 (10.2)	44.6 (7.3)	43.9 (8.5)
Married or likewise (%)	93	75	86	86
Children under 18 year (%)	63	54	73	63
Year in farming *M* (sd)	21.0 (8.0)	19.6 (10.1)	21.9 (10.0)	20.8 (9.3)
Hours worked/week *M* (sd)	48.0 (19.6)	48.3 (15.4)	55.8 (19.1)	50.5 (18.2)
Co-workers on the farm = 0 (%)	27	36	12	25
Co-workers on the farm = 1 (%)	47	36	62	48
Co-workers on the farm = 2 (%)	20	12	19	17
Co-workers on the farm = 3–5 (%)	7	16	8	9
Production types[a]:				
Milk (%)	57	67	65	63
Beef (%)	37	41	46	41
Pig (%)	27	15	19	20
Crop (%)	67	56	65	63
Vegetables (%)	30	7	4	14
Forest (%)	73	67	69	70
Other (%)	20	30	23	24

[a]Multi-choice alternatives.

recruited for the intervention. Four members dropped out early because of heavy workload, shortage of time, change of profession, and having misunderstood the purpose, respectively. Four persons participated in the study but did not attend the final meeting and despite reminders did not respond to the follow-up questionnaire. In total, the questionnaire evaluation was based on responses from 84 participants taking part in most of the meetings. The group sizes varied between seven and 11 persons, and the number of participants at each meeting varied between five and 11. The intervention group was fairly representative demographically concerning gender and years in farming, but farm workers were underrepresented (6%) compared to Swedish farming in general (25%). The median age of farmers in Sweden is 53 years, which is higher than in the present study (44 years). The distribution over production types was representative for agriculture in western Sweden.

Two experienced safety engineers from the OSH Service who had previously taken part in a similar intervention (Eklöf and Törner, 2005) and one doctoral student (behavioural science) acted as process leaders. The process leaders were given a 2-day training session for their roles, and they shared experiences and received support from the research team including a psychologist, after each group meeting.

2.4. Data measures

The questionnaire was based mainly on an instrument from a pilot study among Swedish fishermen (Eklöf and Törner, 2002). It was adjusted to the specific characteristics of agriculture and examined by the two safety engineers specialised in farming and members of the research team. Items were rated on a 6-point scale. The means of the ratings within each dimension were summarised to produce an index variable. Detailed information on the variables 'risk perception', 'risk manageability', 'work stress', 'risk acceptance', 'safety activity' and 'safety measures' is presented in Appendix B.

The intervention implementation process was documented in memos after each meeting by the process leaders. After each round of meetings the research team gathered to discuss the intervention process and feasibility issues. This ensured that the process leaders adhered to the common guidelines and were able to discuss emerging strategic issues. The agenda of these meetings was not a priori decided, but the meetings were allowed to evolve as the process unfolded. The memos kept by process and research leaders were extensively reduced (extracted into essentials) and chronologically ordered.

At the last meeting, 84 of the 88 participants answered an evaluative questionnaire. This questionnaire contained a more detailed evaluation of the intervention concerning changes in attitudes and behaviour and practical arrangements and attendance. Further, the questionnaire covered opinions about possible improvements, as well as an evaluation of the intervention approaches, (S) and (SI).

The process leaders also responded to an evaluative questionnaire at the end of the intervention. This questionnaire covered the practical arrangements, evaluation of meetings and different intervention approaches.

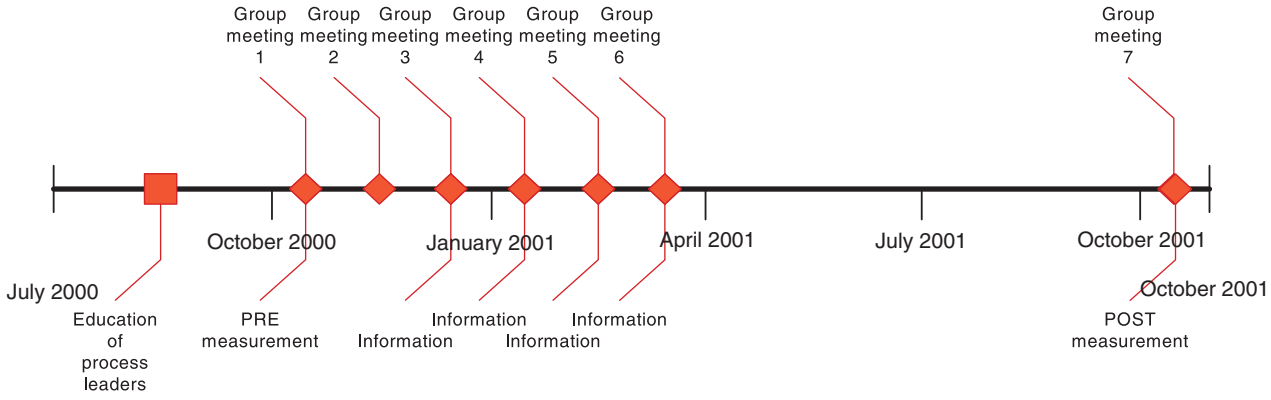

Fig. 2. The intervention process over time.

2.5. Statistical analysis

To reduce the amount of data and achieve better reliability, index variables were created as described above. Cronbach's α (Cronbach, 1990) was used to analyse the internal consistency of variables. Subtracting baseline values from follow-up values gave the change score. Differences in index variables between baseline and follow-up for the entire group were analysed by a two-sided dependant *t*-test. Differences in change score between intervention groups (O, S and SI) and differences in baseline values were analysed by one-way ANOVA for each variable. For all one-way ANOVAs, the Tukey post hoc test was used. χ^2 was used to test for differences in change in 'safety measures' taken between structured and unstructured groups. Differences in change score in 'safety activity' between structured and unstructured groups were analysed by independent *t*-test. *p*-values of <0.05 were considered statistically significant and values of <0.10 were considered to show tendencies. The statistical analyses were made using SPSS 10.0.

2.6. Intervention procedure

A contract was presented and accepted by the participants at the first meeting. The parties agreed on the following responsibilities: (1) participants' experience and reflections on risks and safety should be the major working material at group meetings; (2) participants should be active and contribute their ideas and experiences; (3) the group leader should be informed if any participant was unable to attend a meeting, so that a meeting could be rescheduled to suit as many participants as possible, and a minimum of five participants per meeting was set; (4) the groups designated to use the diary agreed to actually use them. Definitions of accidents and incidents were clarified.

At each meeting, members shared experiences of incident/accidents that had happened since the last meeting. This was followed by discussions intended to find safety solutions. Normally the word was passed around the group and each member had the word at some time. Free discussion was encouraged but the focus was to be on risks, safety and factors that influenced these. There was an emphasis on creating a social climate that would avoid expressions of feelings of guilt or moral judgements.

The groups that used a diary had a more structured way of analysing incidents/accidents (see Appendix A). The groups in which the process leaders gave information on risks discussed and reflected on this at meetings 3–6 (see Fig. 2). All members were asked to present a safety action plan at the sixth meeting.

3. Results

3.1. The pre–post questionnaire

In analysing the entire intervention group, significant differences were found from baseline to follow-up for 'safety activity', which increased, and for 'work stress' and 'risk acceptance', which decreased (Table 2). No significant changes were found for 'risk perception' and 'risk manageability'.

Differences between participants in the different intervention approaches were analysed (Table 3). There was a significant difference at baseline between participants in S and SI concerning safety activity. The post hoc test showed that participants in the SI approach had a significantly higher subjectively stated initial safety activity than those in the S intervention approach. Furthermore, there was a tendency towards a difference in risk perception at baseline, where participants in the S intervention approach initially had a somewhat higher risk perception than participants in SI.

Results showed no significant differences in change score between the three different intervention approaches in any of the index variables.

Results concerning self-reported 'safety measures' showed an increase of 13% after the intervention in the entire intervention group (Table 4). In addition, 94% of those who had taken such measures specified these actions

Table 2
T-tests for all participants showing mean and standard deviation for index variables, pre- and post- intervention, differences of mean (change), 95% confidence interval of change, and t-tests statistics for change

Index variables	Base-line *M* (SD)	Follow-up *M* (SD)	Change *M* (SD)	Change C.I. 95%	*T* (*p*) df= 83
Risk perception	3.98 (0.90)	3.99 (0.95)	+0.01 (0.83)	−0.17; +0.19	0.1 (0.918)
Risk manageability	4.49 (0.84)	4.46 (0.82)	−0.03 (0.86)	−0.22; +0.15	−0.3 (0.735)
Work stress	3.74 (1.22)	3.39 (1.35)	−0.35 (0.11)	−0.58; −0.12	−2.9 (0.004)*
Risk acceptance	2.90 (1.12)	2.61 (0.99)	−0.29 (0.89)	−0.49; −0.10	−3.0 (0.003)*
Safety activity	4.30 (0.89)	4.56 (0.84)	+0.26 (0.81)	+0.08; +0.43	2.9 (0.005)*

Note: *Significant ($p<0.05$).

Table 3
Results for one-way ANOVAs of index variables between each intervention approach, at base-line and for change scores

	Group O open	Group S structured	Group SI structured-information	df	*F* (*p*)
Risk perception					
Base-line	4.04 (0.83)	4.19 (0.83)	3.67 (0.98)	2.81	2.55 (0.08)
Change	0.00 (0.79)	0.00 (0.83)	0.03 (0.91)	2.81	0.01 (0.99)
C.I. 95%	−0.29; +0.29	−0.32; +0.32	−0.34: +0.40		
Risk manageability					
Base-line	4.56 (0.61)	4.54 (0.91)	4.35 (1.00)	2.81	0.48 (0.62)
Change	−0.05 (0.87)	−0.24 (0.76)	0.21 (0.91)	2.81	1.92 (0.15)
C.I. 95%	−0.38; +0.27	−0.53; +0.06	−0.15; +0.58		
Work stress					
Base-line	3.68 (1.32)	3.72 (1.01)	3.83 (1.33)	2.81	0.09 (0.91)
Change	−0.40 (1.23)	−0.17 (0.99)	−0.48 (0.96)	2.81	0.62 (0.54)
C.I. 95%	−0.86; +0.06	−0.55; +0.21	−0.87; −0.09		
Risk acceptance					
Base-line	3.05 (1.34)	2.83 (1.04)	2.82 (0.95)	2.81	0.37 (0.69)
Change	−0.16 (1.15)	−0.52 (0.83)	−0.21 (0.49)	2.81	1.37 (0.26)
C.I. 95%	−0.59; +0.27	−0.84; −0.20	−0.41; −0.01		
Safety activity					
Base-line	4.38 (0.87)	3.96 (0.74)	4.57 (0.97)	2.81	3.60 (0.03)*
Change	0.06 (0.72)	0.40 (0.98)	0.34 (0.69)	2.81	1.50 (0.23)
C.I. 95%	−0.21; +0,33	0.02; +0.78	0.06; +0.62		

Note: *Significant ($p<0.05$).
Means (SD), 95% confidence interval of change. ANOVA-test statistics: degrees of freedom (df), *F* and (*p*-values).

(Table 5). The greatest change occurred in intervention approach S, where safety measures increased by 46%, but had the lowest level of safety measures at baseline. Participants in SI increased safety measures by 4%. In contrast to the other approaches, participants in O decreased their safety measures by 10%. A significant difference in change was found between participants in open (O) and structured (S and SI) intervention approaches ($\chi^2 = 6.80$, df = 2, $p<0.05$).

Analyses were made of the differences between measures before and after the intervention in 'safety activity', comparing the participants in the open approach (O) with participants in the structured approaches (S and SI). A tendency towards a difference in mean was found ($T = 1.72$, df = 82, $p<0.09$) such that participants who made a structured incident analysis showed a higher increase in safety activity than the participants in the non-structured intervention approach.

3.2. Process description

This section describes how the process leaders experienced the evolution of the process.

3.2.1. First group meeting

There had been a reserved attitude but a friendly social climate in most of the groups. The intervention design was discussed and examined during the following meeting of the research team; the question was raised as to whether there were enough incentives for action orientation. The process leaders also expressed concern about what they

Table 4
The percentage of participants undertaken safety measures for each intervention approach before and after the intervention and differences between both occasions

Pre = 3 years before intervention, post = 1 year during intervention	Group O		Group S		Group SI		Group total	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Undertaken measures to improve work safety.	73%	63% diff –10%	36%	82% diff +46%	69%	73% diff +4%	60%	73% diff +13%

Table 5
Type and numbers of safety measures undertaken during the intervention period

Type of safety measures	Numbers
Rebuilding/renovating barns and premises	4
Purchasing new safer equipment and vehicles	3
Mending, detaching, installing interiors/building	20
Mending, detaching equipment and machines	8
Shock-absorbing of sharp interior details	2
Improving skid-safety	4
Improving illumination	2
Improving electrical safety	7
Housekeeping	3
Power transmissions shields	6
Changing routines for chemicals	1
Improving routines/tools with animal handling	3
Improved safety communication	2

should do if there were no further incidents to analyse, and the discussion ended.

3.2.2. Second group meeting

Discussions had become livelier in most of the groups. All process leaders reported a few 'difficult' group members, who dominated the discussion to some extent, questioning the goal or intervention method. Some group members had been frank about their own hazardous mistakes. These persons had opened the way for others, who then dared to share their own experiences. The process leader who lacked detailed knowledge of farming and practical safety work in this area found this lack of knowledge problematic in the dialogue with the farmers.

3.2.3. Third group meeting

Several problems were reported to the research team after the third meeting. A decline in attendance had been noted and fewer incidents had been reported. Process leaders found it difficult to observe, keep notes and lead at the same time, naming insufficient training in group leadership. The structured analysis in the diaries was at times not found applicable. It was clarified that the structure needed not be used literally but as a guide in analysing the incident and its causes.

3.2.4. Fourth group meeting

The process leaders seemed to be content and positive towards their task. Attendance had been good in most groups. The majority of the members had followed the contract, and relevant discussions that focused on safety had been held. There was a tendency among the members to attribute safety problems to external causes. The farmers regarded accidents as incidents and said that some incidents were too normal to take note of. It was observed that the information given to the structured information groups (SI) was received with little interest. The research team agreed to encourage the members to make plans for safety activities and to become more action oriented.

3.2.5. Fifth group meeting

The discussions had tended to run short of incidents to discuss and analyse, but the focus on safety had still been very good. Some meetings had been rescheduled and some were held with few participants. This was, however, not considered a major problem. In some groups the members were already well acquainted with one another, which seemed to have an inhibitory effect on openness in the group. No progress in safety activity had been reported, and the process leaders were advised to remind the members of the contract and the goal of increasing safety activity.

3.2.6. Sixth group meeting

The sixth was the last of the monthly meetings and many had attended with a social focus. The group climate was good in most of the groups, with positive social support. The information given to the structured information group (SI) had received a weak response and did not seem to encourage discussion but rather to trigger a defensive attitude. In most of the groups, little increase in safety activity was noted by the process leaders, and few had developed a safety action plan. It was stressed that safety action plans ought to be presented by the members at the final meeting, 6 months later.

3.2.7. Seventh group meeting

Attendance at this last meeting had been good. The farmers had had difficulty remembering incidents during the 6 months that had passed since the last meeting, since very few had used their diaries. Memories of incidents were

however retrieved since one event provided clues for others to follow. The structured analysis was considered a help in analysing the accidents, in the search for preventive safety measures.

3.3. Evaluation of feasibility and activities

3.3.1. Practical arrangements and attendance

The practical arrangements, procedures and locations functioned well. Almost all of the participants stated that the number and frequency, as well as the time and duration of the meetings, were adequate. Varying degrees of attendance between meetings allowed input of both depth and breadth. The intervention was well received since the farmers came, stayed and were highly engaged in the process. Little deviation was made from the intended structure, and disturbances from outside the intervention were not noted.

3.3.2. Evaluation of meetings and activities in the groups

Nearly all of the participants reported that their awareness of risks and hazards at work, as well as their knowledge and motivation to improve safety, had improved due to the intervention. The activity of the group members was considered adequate by all but five of the participants who wanted more. Everyone stated that they had had the opportunity to speak and to be heard. Seventy-six percent of the participants stated that they would like the opportunity to continue the safety meetings in the same way, e.g. arranged by the Farmers OSH services. Process leaders noted differences in patterns of activity between the nine groups, but no systematic differences in activity were noted between the three different intervention approaches. The leaders rated questions about activities within the groups, which are presented in Table 6.

3.3.3. Evaluation of the structured group types (S) and (SI)

Most of the participants (83%) of groups S and SI stated that they had used the incident diary, but as many as 60% only once or twice, while 23% used them between every meeting. Two thirds found the diary useful and indicated that the structured way of analysing the incidents had affected their view on risk and safety at work. One third of these intended to continue to use the diary. One hundred and forty-two accidents were analysed during the intervention, i.e. an average of eight per meeting. The effect of the structured analysis was stated as a change in reasoning, e.g. 'Now I think before I act' or 'I'm more careful now'. One leader found that, 'There has been a real understanding of the analysis due to one member who was open and dared to discuss it thoroughly. After that, the others understood the use of finding the causes and ways of avoiding them'.

The process leaders stated that the information given to the SI group generated very little interest. The information even made some of the participants defensive, trying to motivate the actions or lack of actions of farmers.

3.3.4. Possible improvements

Eight percentage of the participants stated that the following issues had not sufficiently been discussed: chemicals, air, noise, child safety, psychological health, time pressure, stress and disease problems. Eleven percent of the participants expressed a wish for more time, even better attendance and more 'non-perfect' participants.

Table 6
Activities of the nine intervention groups evaluated by the process leaders

Statements	Not correct (%)	Correct (%)
1. The groups showed a great interest in safety related subjects that were discussed	11	89
2. The groups were active in providing ideas and suggestions	33	67
3. The meetings were characterized by an open and free discussion		100
4. The meetings were constructive concerning ways to find safety solutions	56	44
5. The discussions concerned concrete working conditions rather that general problems		100
6. Problems, ideas etc. were discussed thoroughly and seriously	11	89
7. During meetings, clear intentions were declared concerning continued work on safety measures	67	33
8. The group members encouraged each other in providing ideas and discussions	44	56
9. One or a few members within the groups were dominant	78	22
10. The work within the group was negatively affected by conflicts	100	
11. All members within the groups were active in the discussions, e.g. not only some spoke	22	78
12. The groups showed a positive evolution over time, through an increased engagement in own safety activities on the farm	33	67
13. The discussions and reflections on reported incidents and accidents, lead to an increased insight within the group about underlying causes. e.g. that accidents do not strike as lightning but are proceeded by a chain of events	33	67
14. The group members were supportive and thus showed an understanding with the ones that reported about own experiences of incidents/accidents	33	67

The leaders rated questions about activities on a 6-point scale with the endpoints 'not at all correct' and 'entirely correct'. The results were dichotomised and figures indicate percentage of process leaders' assessment of groups that correspond or not correspond to the statements.

Some suggested information beforehand on next meeting's agenda and more demonstrations of good equipment.

4. Discussion

4.1. Method

Several statistically significant differences between pre- and post intervention measurements were found. These differences could, however, not be unequivocally attributed to intervention effects because no control group was used (Cook and Campbell, 1979). Participation was based on geographical vicinity and an interest in participating. This was due to practical reasons in terms of creating sustainable networks, i.e. it was desirable that the participants in a group lived near each other and could quickly reach the meetings after work, frequently and over a longer period of time.

The questionnaire was validated in two prior studies (Eklöf and Törner, 2002; Stave et al., 2006). The measures of risk acceptance and activity in safety work may suffer from validity problems due to reporting bias and narrow operationalisation. Activity in safety work may also involve activity that is primarily designed to improve some other aspect of work but also leads to improved safety. Our measure focused on activity that had safety as one of its explicit aims, and thus the operationalisation was narrow. It should also be noted that the measure of activity in safety work showed less than satisfactory reliability. It contained only three variables, and in further development these should be supplemented with further variables. The index variable of work stress contained only two variables and could be further improved by adding more validated variables from previous stress research.

The validity of self-reported data may be questioned (Kjellberg and Franzon, 2002) but, since safety activity was supported by specified safety measures taken, the results were strengthened. It is also possible that the ratings may suffer from social desirability, since, although data collection was made anonymous, it was within the context of being part of an occupational safety project. The process leader effect was however outbalanced by each leader being responsible for one group of each intervention approach.

Mean group meeting attendance was fairly high, namely 77% (approach O), 85% (approach S) and 65% (approach SI). There is no reason to believe that the differences in attendance between approaches would influence results when comparing the effects of the different approaches, since no single individual was more consistently absent. There was a low drop-out rate among the participants, which increases the validity of the results and points towards a high motivation to follow the intervention to its completion. Since the results showed a positive effect of the intervention it would be of interest to conduct a long-term follow-up to explore the sustainability of the results.

The description of the intervention process was made by the leader and research team, themselves part of the intervention. An independent observer and evaluator may have made other findings. Interviews with participants may also have provided deeper and more detailed evaluations.

4.2. Effects on the entire intervention group

Risk perception and perceived risk manageability did not increase after the intervention. This may indicate that farmers are already aware of the hazards in farming (DeRoo and Rautiainen, 2000). Murphy (2003) also discussed the farm safety-risk paradox, that is, the incongruence between farm people's safety knowledge, values and practices.

Relations between risk perception and safety activity are complex and not yet fully understood (Rundmo, 1996; Lund and Aarö, 2004). A hypothetical model encompassing these variables and risk manageability, work stress and risk acceptance was tested in empirical material related to the present study (Stave et al., 2006). Work stress was there found to be a factor counteracting safety activity. Perceived work stress was in the present study significantly reduced after the intervention. However, participation in the intervention may have caused changes in participants' conceptualization of and internal standards for stress and safety activity (Westlander, 2003). Difference scores may thus have been influenced by changed standards for rating stress and activity.

The groups, as intended, acted in a socially supportive way and encouraged a problem-focused coping strategy. This may have contributed to the reduction in stress (Lazarus and Folkman, 1984). Stress has been found to be a problem in farming (Kidd et al., 1996; Glasscock et al., 1997; Simkin et al., 1998; Törner et al., 2002) and may be expected to increase as a result of the ongoing structural changes in agriculture. In spite of such structural change a reduction in job stress was noted, which lends support to positive effects of the intervention.

Subjectively stated safety activity increased significantly in the entire group after the intervention. These results were supported by an increase in specified safety measures of 13% for the whole group. The predictive validity of these results, i.e. whether an increase in safety activity leads to a decrease in accident rates, cannot be judged on the basis of the present results, but Harrell (1995) and Varonen and Mattila (2002) found a negative correlation between safety behaviour and involvement in accidents.

Risk acceptance decreased significantly in the whole group after the intervention, which may indicate that the basic concept of group discussions may have influenced attitudes towards risks. Lund and Aarö (2004) stated that, by influencing through long-term measures, attitude change might contribute to changing social norms.

4.3. Effects in the three intervention approaches

There were no differences in change between the three intervention approaches in the index variables. However,

the structured analysis groups, S and SI, showed a greater change in safety activity and in safety measures taken. Thus, it seems that providing additional structure to the basic concept of group discussions was beneficial. Although the diaries, which were part of this structure, were not always used in full, they provided information about many incidents experienced by the actors and usually easily recognisable also by the rest of the group. These concrete events stimulated individual and group reflection on the event, clarifying different preconditions and the need for proceeding into action to enhance safety. These results should be interpreted with caution, however, since the participants in intervention approach S had a lower safety activity and took fewer safety measures at baseline, thus making their potential for change greater than the other participants. Also, Schwebel et al. (2002) used an injury diary in a study of children's accidents and recommended it for interventions for identifying hazards and behavioural patterns.

Finally, the results showed no additional positive effect of providing information in a theoretical educational manner that focused on the negative consequences of risks, which further emphasises the low impact of purely educational approaches.

4.4. The process and feasibility

The process description and evaluation showed that the feasibility of the intervention method was high. Contextual adjustments were considered important in order to motivate participants to follow through an intervention of extended duration. The good attendance and low dropout may also indicate that farmers were initially motivated in the subject and continued to be so.

The process leaders had difficulty establishing whether any change in safety attitude or activity had been accomplished. Changes in attitude do not always manifest themselves in verbal statements or in visible measures undertaken. According to the transtheoretic model, TTM (Prochaska and DiClemente, 1982), the verbal processes of change, consciousness raising and choosing are most important in preparing for action, while the behavioural processes may not be verbalised. This may explain why the process leaders did not see many signs of actual safety activities taking place. However, a majority of the participants reported a change in their risk awareness, knowledge and motivation due to the intervention. This change may be referred to the cognitive change stated as a result of structural incident analysis, 'Now I think before I act', a behavioural change that is difficult to measure or observe. In a behaviour-based intervention, Sheeran and Silverman (2003) found that implementation intentions significantly increased behavioural change. A one-sided emphasis on studying behavioural change may miss important intervention effects on a cognitive level (attitudes and intentions). Such effects may be necessary in preparing participants for a change in behaviour (Haslam, 2002).

The social network was the most appreciated part of the intervention. A trustful and non-judgemental climate within the group and supportive members that were willing to openly discuss and analyse their own shortcomings and problems were important. One obstacle to even further openness may have been that some group members worked together. It may be easier to be frank with people from different workplaces. However, participants were chosen on the basis of geographical vicinity in order to facilitate sustainability of the network.

The role of the process leader was reported to be demanding but manageable, and a need was expressed for more training in process leadership. The process leaders e.g. felt that it was difficult to remain in the role of consultant and to refrain from entering an expert role. The OSH services are frequently used consultants in the area of safety but need increased competence as process leaders. Supplying such education was the purpose of choosing OSH personal as process leaders. Through this, the method could have been carried on. Unfortunately this did not become the case because of a substantial restructuring of farmers' OSH services.

5. Conclusions

- Due to the design of the study, no firm conclusions about effects could be drawn. However, the results suggested that the intervention methodology, i.e. creating networks for social support, facilitating discussion and reflection with a focus on risk manageability, may have resulted in a desired change in safety activity. The findings need to be further tested and evaluated in future intervention research.
- The structured analysis of incidents provided a basis for safety reflection, promoting safe behaviour, stated as 'Now I think before I act'. However, providing educational information on risks on a generic level offered no additional benefit.
- Participation in a supportive network was reported as highly beneficial, and an honest and non-judgemental climate was important. The leader of a change process in networks should be aware of its ambiguous and sometimes fluctuating character.
- The feasibility of the intervention methodology used in this study was high and a process of long duration appears to be important for attaining attitude and behavioural change.

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Appendix A

Information and questions presented within the diary given to the participants in intervention approaches S and SI. Detail information about numbers and type of accidents that were analysed is presented in (Törner et al., 2002).

Support for incident/accident analysis

- Fill in the diary as soon as possible after the event.
- Try to take a time every week and think though what had happened during the week.
- Date:
- Time:
- Type of injury:
- Describe what happened:
  - When, where and how did the incident/accident occur?
  - What was different at the time of the event? In the surroundings, with equipment, with ourselves, with others or how you worked.
- What happened *before* the accidents?
  - In the surroundings, with equipment, with yourself, with others or how you worked?
- What in your opinion was the most important cause of the accident?
- Which other causes may have influenced the incident/accident?
- If nobody was injured, how was the injury avoided?
- How can similar incident/accident be prevented in the future?

Appendix B

The following dimensions were covered in the questionnaire:

Risk perception was explored by rating risks associated with 12 different working activities on farms. The 12 activities were selected through an analysis of serious accidents in Swedish agriculture made in a pre-study (Stave and Törner, 2000). The items were presented as: 'How high do you estimate the risk to be that you will be injured in connection with *X*?' Scale endpoints were 'very low risk' and 'very high risk' (Index variable reliability, calculated as coefficient α, was 0.88).

Risk manageability was rated for each of the 12 hazardous work tasks. The items were presented in the following way: 'Accident risks associated with *X* can be reduced with technical equipment and changes in working methods'. Scale endpoints were 'not at all correct' and 'entirely correct' (α 0.86).

Work stress was stated by 65% of a strategic sample of farmers and farm workers in a pre-study (Törner et al., 2002) as the primary cause of the high frequency of accidents in agriculture. Main stressors named were economic concerns, time pressure and high workload. Work stress was therefore studied by asking the respondents to rate their level of stress in the following two statements: 'Stress due to time pressure and high work load is a problem for me' and 'I worry about the future'. Scale endpoints were 'not at all correct' and 'entirely correct' (correlation of the items was $r = 0.31$ $p < 0.01$).

Risk acceptance was studied through the following items: 'You have to learn to live with the risks at work', 'A farmer/farm worker should be able to take care of him/herself', 'A farmer/farm worker should be prepared to take risks' and 'A farmer/farm worker should enjoy challenging the forces of nature'. Scale endpoints were 'not at all correct' and 'entirely correct' (α 0.73).

Safety activity was studied through three items: ' I try to find methods and equipment to improve safety', 'We who work on the farm co-operate to improve the safety work' and 'My co-workers or farm work colleagues and I often discuss how to make our work safer'. Scale endpoints were 'not at all correct' and 'entirely correct' (α 0.58).

Safety measures were actions actually undertaken to increase safety. The respondents were asked to answer 'yes' or 'no' to the following question: 'Have you, during the last 3 years (baseline investigation)/ in the last year (follow-up investigation) taken any measures to improve safety in your work at the farm?' An open question was added in which the actions were specified.

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