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ACCIDENT PREVENTION THROUGH EXPERIENCE FEEDBACK FROM THE RESCUE SERVICES - A STUDY OF INCIDENT REPORTS IN SWEDEN

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ABSTRACT

The fire and rescue services are called to the scene of almost all serious accidents. The purpose of this investigation was to find out whether the information they obtain in the course of their normal operations can be used to improve experience feedback from accidents. 1120 incident reports from two local Swedish fire and rescue services were studied. These reports contained 217 proposals for improvement. However, the reports are primarily intended for statistical purposes, and currently they are not used systematically for experience feedback. A system for dissemination of such information is proposed. It is suggested that the rescue services should themselves convey the relevant information to local recipients, whereas a national authority should be responsible for collecting and distributing information to non-local recipients such as companies whose products have been involved in an accident and regulatory authorities whose regulations may be in need of reassessment.

Objectives: One aim was to find out whether information obtained in the fire and rescue services regular work can contribute to a more efficient and comprehensive experience feedback system. If the answer to this question is positive, what organisational measures are needed to realize this potential?

Methods: Document studies, additional interviews.

Results: 217 different proposals for improvement were found in the studied incident reports. Overall, the improvement proposals are concrete and directly implementable. Yet, the dissemination of improvement proposals is not a reality today.

Conclusions: The fire and rescue services obtain valuable information for preventive work. Thus, much can be gained by disseminating information from the incident reports. In a properly working dissemination process recipients need to be identified. Recipients can at first be divided into two major categories: local and non-local recipients.

Keywords: experience feedback, learning from accidents, prevention, fire and rescue services, incident report, intervention report.

1. INTRODUCTION

Experience feedback is generally recognized as an essential component of any efficient strategy for accident prevention. It consists of the systematic collection, analysis and dissemination of information from incidents and accidents in order to prevent new accidents. However, in spite of its importance for accident prevention experience feedback is an established routine only in some sectors in society. In most industrialized countries, institutions have been created for experience feedback from accidents on workplaces, and reporting systems have also been created that cover accidents on roads and in the railroad system. Furthermore, the aviation industry, the nuclear industry and the offshore oil and gas industry all have well-developed systems for the reporting of accidents and incidents. These industries also have extensive international exchange and co-operation in accident reporting. In contrast, learning from accidents for instance in homes [1, 2], on playgrounds, [3] or in the tourism sector [4] is much more sporadic, in spite of the high prevalence of accidents in these areas. The extension of systematic experience feedback to accidents in all social sectors would seem to be a major step towards more efficient accident prevention.

The fire and rescue services are called to the scene of serious accidents, also in sectors where experience feedback is currently weak or non-existent. In this way they receive information about most types of accidents. Can this information be used to improve and systematize experience feedback from these accidents? In order to find a tentative answer to that question, information collected by local Swedish rescue services was studied. Two major operative research questions were investigated: (1) Is the information obtained by the rescue services in their normal operations potentially useful in an extended experience feedback system that covers accidents in all social sectors? (2) In that case, what organisational measures are needed to realize this potential?

In Sweden, all interventions by the local fire and rescue services are reported in an incident report form that is recorded in the national fire and accident statistics. We used the information available in such incident reports to answer our research questions.

In Section 2 the Swedish rescue services are briefly introduced. In Section 3 the method used in this study is presented, and in Section 4 the results are reported. In Section 5, these results are combined with information from previous research, and conclusions are drawn on how the rescue services can contribute to more efficient experience feedback.

2. THE SWEDISH RESCUE SERVICES

Sweden is divided into 290 municipalities, each of which has independent powers of taxation and a considerable degree of autonomy. Each municipality is legally required to provide adequate rescue services within its borders. (National government is responsible for maritime and aeronautical search and rescue, and it also coordinates mountain rescue services.) Some adjacent municipalities have chosen to combine their resources and organise their rescue services jointly. The total number of municipal rescue services in Sweden is therefore 193 [5]. Their responsibilities are essentially the same as those of corresponding organisations in other countries and include fire fighting as well as rescue activities in virtually all types of accidents and emergencies.

All interventions by the rescue services have to be documented in an incident report form that is the same for all municipalities. The officer in charge of the operation has to fill in the form as soon as possible after the intervention was completed. The main report form consists of four pages and covers many aspects of the accident and the rescue operation. One of its headings is “Suggestions for improvement”. It is followed by three subheadings each of which has space for written comments:

Measures to prevent similar accidents

Measures to improve protection against similar accidents

Measures to make similar rescue operations more efficient

Each month the incident reports are submitted to the Swedish Civil Contingencies Agency that summarizes them in the national fire and accident statistics [5].

3. METHOD

In order to obtain sufficient statistics, the aim was to collect at least 1000 incident reports for the analysis. Since rescue activities differ between cities and rural areas, it was important to include reports from both a city-based and a rural fire department. It was also important to establish contact with at least one superior officer at each of the participating departments who was willing to explain technicalities and clarify the contents of the reports. Based on these criteria, the Greater Stockholm Fire Brigade recommended Katarina Fire Station in the centre of Stockholm (population approximately 390 300) and Norrtälje rescue services in a rural town around 70 kilometres northeast of central Stockholm (population approximately 56 000). Both departments were willing to take part in the study.

We analyzed all the incident report forms from 2006 in these two departments. 1053 reports were available from Katarina and 562 from Norrtälje. 365 of the reports from Katarina and 126 of those from Norrtälje referred to false automatic fire alarms. Only two of these were found to contain information relevant for experience feedback, one from Katarina and one from Norrtälje. The rest of these reports were not included in the database since they did not contain information that could be used in the study. Six additional reports from Katarina were excluded because they were incomplete or did not contain any information at all. This resulted in a total of 1120 incident reports, 683 from Katarina and 437 from Norrtälje.

A database was created that contains relevant information from all the studied reports. For each report the file number and incident category were included in the database, along with basic information about the accident or incident and all the information provided under the heading "Suggestions for improvement".

In addition to the information taken directly from the incident reports two further types of information were included in the database. First, the division into standardized incident categories was not sufficiently detailed for the purposes of this study. One example of this is the category "Fire not in buildings" that included several types of fires that have to be treated differently with respect to experience feedback. Therefore, subcategories such as "fire in vehicle", "fire from outdoor barbecue", etc. were added. The further analysis was based on this extended version of the official categorization of incidents.

Secondly, all proposals for improvement were analyzed against the background of the additional information available about the incident in order to identify the most relevant potential recipient(s) who could implement the proposed preventive measures. The potential recipients were entered into the database. In the further analysis they were categorized according to what social sector they belong to.

4. RESULTS

The total number of proposals for improvements found in the reports was 217. No systematic differences between the two fire departments were found. Therefore they will not be treated separately in what follows.

The proposals for improvement differ in nature. Many of them are concrete and directly implementable, such as proposals to change traffic rules on specific accident-prone roads and to change work routines on workplaces where an accident had occurred. Others are less instructional, and a few of them seem to express the report writer's frustration rather than his ideas on how improvements could be brought about in practice. ("Forbid alcohol.") *Table 1* shows the distribution of the incident reports and the proposals for improvement over the official incident categories and our subdivision of these categories.

Table 1.
The left column shows the standardized incident categories that were used in the reports (boldface) and the further subdivisions of some of these categories that were used in this study (italics). The middle column reports the number of incident reports in each of these categories and the right column the total number of improvement proposals in the reports in each category. The ”uncategorized” reports (last row in the column) were those in which the box for incident category had not been filled in.

Incident category and subcategory	Incident reports	Improvement proposals
Fire in building	**158**	**62**
Fire in common area	*19*	*9*
Fire in kitchen	*29*	*13*
Fire due to machine failure	*27*	*8*
Fire in bedroom	*3*	*1*
Fire in heating system, chimney fire	*20*	*7*
Fire in building, other	*60*	*24*
Fire, not in buildings	**237**	**46**
Fire in vehicle	*52*	*11*
Waste container, garbage can	*47*	*3*
Deliberate fire	*22*	*10*
Wildfire	*10*	*2*
Fire from outdoor grilling	*15*	*7*
Other	*91*	*13*
False alarm, fire	**12**	**1**
Supposed fire	**186**	**13**
Stove-top fire	*38*	*4*
Other	*148*	*9*
False alarm, rescue	**12**	**3**
Supposed rescue	**12**	**2**
Other accident	**65**	**13**
Suicide threat	*8*	*5*
Leakage	*34*	*2*
Fire	*3*	*2*
Rail accident	*3*	*0*
Spill containment	*1*	*0*
Stove-top fire	*2*	*0*
Other	*14*	*4*
Landslide	**3**	**1**
Other mission	**160**	**13**
Waiting for ambulance	*2*	*0*
Delegated healthcare tasks	*71*	*4*
Helping ambulance	*20*	*3*
Helping the police	*4*	*0*
Elevator, not emergency	*12*	*2*
Other	*51*	*4*
Water damage	**27**	**4**
Weather	*8*	*1*
Other	*19*	*3*
Drowning	**10**	**1**
Animal in distress	**7**	**0**
Person in distress	**15**	**7**
Storm damage	**17**	**3**
Road traffic accident	**132**	**27**
Emission of dangerous substance	**19**	**8**
Uncategorized	**48**	**13**

Table 2 reports the assignment of potential recipients to the proposals. The recipients were divided into eight major categories: homes and apartment houses (home owners, landlords, authorities responsible for building codes etc.), the public space (those responsible for parks, pavements etc), transportation, companies (risks arising in their own activities), dangerous equipment (risks from products sold by a company), the social sector, law enforcement and the penitentiary system, and finally the fire and rescue services themselves.

Table 2.
The left column shows the eight recipient categories, i.e. categories referring to the type of recipients who can be expected to make use of the proposals for safety improvement, that were found in the incident reports. The right column shows the number of proposals in each category.

Recipient category	**Number of proposals**
Homes and apartment houses	49
Public space	14
Transportation	43
Companies	20
Dangerous equipment	11
The social sector	15
Law enforcement and the penitentiary system	3
Fire and rescue services	62

Homes and apartment houses

14 of the 49 proposals in this category referred to stoves and to the prevention of stove-top fires. These proposals include: install a timer, install a flame detector, and use a stove with overheat protection. Proposals not referring to stoves include improved maintenance of chimneys and boilers, installing smoke detectors in apartments and houses, installing fire sprinklers in garbage rooms, and keeping fire extinguishers in homes and common areas. Most of these proposals are primarily directed at the respective house owner or landlord. There is no routine for notifying them; in particular large landlords with multiple properties may not always be aware of an intervention by the rescue services. The information contained in these proposals may also be relevant for authorities such as the Swedish National Board of Housing, Building and Planning that is responsible for building regulations and the National Electric Safety Board that is responsible for regulations concerning the safety of electric equipment. Neither of them receives this information.

Public space

The 14 proposals concerning public space contained a variety of recommendations, such as fire safe recycling bins for paper, rescue ladders in harbours, fences to prevent access to places often used for suicide jumps, and improved snow removal. Most of these proposals directly concern the municipal administration of which the rescue services are a part. However, there are no routines for conveying these proposals to the responsible municipal decision-makers.

Transportation.

Of the 43 proposals on transportation the vast majority (36) concerned road traffic. Many of these referred to mistakes by individual motorists (keep speed limits, use seat belts, do not drive drunk, etc.). Others recommended improvements on specific roads, such as wildlife fences, wire rope barriers, roadside hazard tree removal, asphalt repair, lowered speed limits, and erection of a stop sign. These proposals are clearly intended for the Swedish Road Administration but there is no routine in place that provides them with the proposals that concern them. Six proposals pertained to shipping (concerning for instance sprinklers, fire alarms, mooring, and gangplanks) and one to rail traffic (preventing unauthorized access to a railroad track area). Neither the concerned companies nor the relevant authorities for maritime respectively railroad traffic receive any information on a regular basis on these proposals.

Companies

20 of the proposals concerned risks in the activities of local companies. Most of these proposals pertained to problems in the building industry, such as various fire hazards, loose metal plates tossed around by a storm, an insufficiently anchored pile driver that turned over, etc. Proposals were also made for other companies, such as a supermarket (water overflow in a cold storage room), a power company (forest clearance under transmission lines), and an agricultural company (removal of external ladders that had been used for unauthorized access to the roof of a silo). These proposals are all directed to local companies. Presumably, the information was in most cases imparted informally to the company during the intervention, but there is no routine for insuring that it reaches the company. Furthermore, this information is highly relevant for the Work Environment Inspectorate, but there is no routine for conveying it to them.

Dangerous equipment

Of the eleven proposals in this category, four concerned elevators. This included one elevator that could be started in spite of being too heavily loaded, and another whose doors could be opened when the cage was out of position. Various other cases of malfunction or faulty construction were reported, such as a table fan that melted when overheated, a dishwasher that started a fire, and inflammable products with insufficient warning labelling. The information contained in these reports is clearly important for the producers of these products and for the government agencies responsible for overseeing them, but there is no system for providing them with the information.

The social sector

15 proposals belonged to this category. Most of them were occasioned by stovetop fires or other accidents in the homes of elderly persons. According to the reports, some of these residents were in need of improved custodial care (in Sweden provided by the municipal social services) or would possibly have to move to an assisted living facility. However, there is no routine for communicating such information to the municipal social services.

Law enforcement and the penitentiary system

Three proposals belonged to this category. One concerned inflammable mattresses in prison cells and another the need to search prisoners for matches and lighters. The third referred to fire prevention routines in a police station garage.

Fire and rescue services

By far the largest group of proposals, 62 of them, concerned the rescue services themselves and how future interventions of the same type could be made more efficient. These proposals referred to all aspects of the intervention such as navigation to the site of the accident, coordination with the police and emergency medical services, problems with the equipment, the need for better safety routines (e.g. safety grounding) and improved preparation, training and education (for instance in the use of defibrillators). These proposals differ from those in the other categories in being mainly directed at the organisation within which they were written. According to our informants at the two fire departments the experience from interventions that is recorded on the incident report forms is frequently discussed in the organisation and forms the basis for improvements in work methods.

5. DISCUSSION

This study was performed in order to answer two major questions. The first of these was whether the information obtained by the rescue services in their normal operations can potentially contribute to a more efficient and comprehensive experience feedback system. This question can now be answered in the affirmative: It can be seen from our analysis of the incident report forms that the fire and rescue services obtain valuable information that can be used to prevent future accidents. Since there are no reasons to believe that the two studied departments differ drastically from most other departments in terms of the types of accidents they attend to, this conclusion appears to be generalizable. (However, since one of the criteria of selection for the two departments was the presence of an officer with an interest in preventive work, it is a plausible hypothesis that the prevalence of such information may be smaller in reports written in other departments.)

The second question is what measures are needed to realize this potential. As we see it, two major types of consideration need to be taken into account when answering that question: the quality of the reports and their dissemination. Concerning the quality, it should also be noted that the text on "proposals for improvement" was very short in many of the incident reports. It is reasonable to believe that there is space for improvement. Education of the reporting staff and feedback from the recipients can hopefully increase the quality of the reports.

Concerning dissemination, previous research has shown that the publication of information on accidents in a publicly available database is not sufficient to ensure that this information is made use of in preventive work. As was noted by Trevor Kletz, accident databases have been used to a surprisingly low extent by people responsible for accident prevention. [6] Active dissemination is therefore necessary. In other words, information from the reports needs to be sent to persons and organisations who are in a position to use it to prevent future accidents or reduce their consequences. This is in our view the essential step that needs to be taken in order to ensure that this information is used for accident prevention. Previous research shows that lacking or insufficient dissemination tends to be the weak link in experience feedback. [7, 8, 9].

In terms of practical arrangements, it seems adequate that the officer responsible for an intervention is also responsible for writing the post-intervention report. Possibly, the quality of the proposals for preventive work could be improved if the reports are discussed at regular local meetings within the rescue services. The most practicable way of providing recipients with the information is probably to send out standardized letters to which copies of the report are appended. This should probably be the task of a specially assigned person at each local authority (who can then also be responsible for removing classified or privacy-sensitive information that should not be passed over to the recipients).

The first step in dissemination should be the identification of suitable recipients for the information. Finding all the relevant recipients may be difficult, but judging by our experience from this project, one or two recipients can be identified in almost all cases by someone who has a modicum of knowledge about the distribution of responsibilities among authorities, private organisations and companies in (in this case) Sweden. There were two major categories of suitable recipients: (1) local recipients such as municipal authorities and companies and landlords within the municipality, and (2) non-local recipients such as companies whose products are involved in accidents and national authorities responsible for regulation and oversight in various areas. Two further items should be added to the incident report form, namely "Local recipients of proposals" and "Other recipients of proposals". Checkboxes for the more common recipients may facilitate the filling in of the forms. When it comes to local recipients, it would seem most efficient for the municipal rescue services themselves to be responsible for conveying the information and taking appropriate follow-up contacts. For non-local recipients a more centralized procedure may be more suitable. One option would be that a single central authority (such as the Swedish Civil Contingencies Agency) reviews and collates the proposals before they are sent to other authorities and/or private actors.

The purpose of experience feedback is to prevent accidents. As was noted by Johnson and Holloway, the process has not come to a conclusion until its recommendations have been implemented for the future safety of the system to be protected [8] and it was stated by for instance Sweedler [10] that accident investigations is just one step along the way. Therefore, we propose that at least some of the letters with accident information that are sent out to (local and non-local) recipients contain a request for an answer within a specified period of time, reporting what measures have been taken by the recipient in response to the information. For this to be meaningful, follow-up routines will have to be developed.

Whatever dissemination and follow-up method is chosen, it should be evaluated after a couple of years in order to determine if it is inclusive and swift enough, whether the intended recipients actually receive the information, and whether they use it to prevent accidents. In particular, it is essential to determine whether actual accident prevention, the ultimate purpose of the procedure, does in fact take place. As we noted in a recent review, this has seldom been directly addressed in previous studies of accident investigation and feedback procedures. [11, pp. 719-720]

Although we are convinced that the rescue services can contribute much more than today to experience feedback and learning from accidents, we also want to point out two important limitations in what they can do. First, the rescue services are called to the places of completed accidents, but seldom to the sites of near misses or other safety-critical incidents. There is ample empirical evidence that many accidents could have been prevented if warning signals from incidents and near misses had been made better use of in preventive work. [12] Several authors have pointed out that there is a positive correlation between the number of near misses and that of major accidents. [13, 14] Practical experience corroborates the usefulness of incidence reporting. One example is a major offshore company that puts much emphasis on incident reporting. The number of accidents decreased

substantially when incident reporting was introduced in the company in the late 1980s, and the reporting system is believed to continue to contribute to safety awareness in the whole organization. [15] Reporting through the rescue services will inevitably have a strong focus on completed accidents rather than on incidents and near misses. Whenever possible it should therefore be supplemented with reporting by persons who are in a better position to keep track of incidents.

Secondly, the rescue services write their reports immediately after their intervention, without performing any time-consuming investigative measures. Police reports written immediately after an accident have been shown to be unreliable with respect to indirect causes [16]. The same problem can be expected for incident reports from the rescue services. In contrast, modern accident investigation methods focus on finding underlying, often much less evident causes of an accident. [8, 17, 18] It is essential for preventive work that such underlying causes be discovered. Therefore summary reports from the rescue services cannot replace the more extensive accident investigations that are needed for serious or otherwise problematic accidents. (Possibly, reports from the rescue services can be used in decisions on what accidents to prioritize for in-depth investigations.)

Finally, it should be emphasized that this study was concerned with the Swedish system for incident reports. We believe that some of its conclusions are highly relevant also for other countries. This applies in particular to the most important conclusion, namely that in the course of their normal activities, the fire and rescue services obtain information that is useful for experience feedback in many segments of society. However, our findings on the contents and quality of the incident reports cannot be transferred to other countries. The precise ways in which information from the activities of the fire and rescue services should be collected and communicated will probably be different in different countries, depending on organisational and other social preconditions.

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