

Patient-Centered Process Optimization in A German Emergency Department With A Particular Focus on Sufficient Pain Management

A Best Practice Model for the Continuous Improvement of Quality and Patient Satisfaction

Patrick Ristau B.A.

Department of Nursing and Health Sciences
 Protestant University of Applied Sciences Darmstadt
 Darmstadt, Germany
 kontakt@patrick-ristau.de

Dr. Stephanie Pfeuffer

Department of Nursing and Health Sciences
 Protestant University of Applied Sciences Darmstadt
 Darmstadt, Germany
 pfeuffer@eh-darmstadt.de

Abstract—While pain is the main reason for patients to visit a hospital’s emergency department (ED), it is a hardly explored phenomenon in this context. Moreover, while effective pain management is the most important dimension of patient satisfaction in EDs, there is a lack of studies in Central Europe which could be used for optimizing the deficient pain management in these units. This study will clarify whether the implementation of an interdisciplinary structured pain management improves the care of patients in the emergency room and whether its use improves patient satisfaction. Additionally, it investigates whether the implementation of such a structured pain management system will also bring advantages for the work of personnel employed in the emergency room. To this end, a multimethod approach was chosen, in which both the patients treated in the emergency room and the staff working there were interviewed by a written survey during a two-week examination period before and after the implementation. Included were all patients of the somatic departments who met the ethical criteria, as well as all doctors and nurses. Data analysis and processing was carried out using Microsoft Excel. It was found that the use of a structured pain management system leads to better, more effective pain treatment of the patients in the emergency department and increases their overall satisfaction with their treatment. Furthermore, it is easy to use by the staff and reduces their workload so that they have more time to spend on patient care.

Keywords: patient satisfaction; emergency department; process optimization; pain management; stakeholder focusing; best practice

I. INTRODUCTION

The Emergency Departments (EDs) of German hospitals have faced an increasing number of patients for several years. In 2013, more than 23 million patients were treated in German EDs, about 60% of whom were outpatients [1,13]. There is also a trend towards shorter periods of stay and fewer hospital beds. [14] At the same time, EDs have become one of the main gates for patients of any kind to enter the hospital. More than one in three inpatients is admitted via ED [2,12]. Hospitals have reacted to this development by setting up central emergency departments, whose strengths lie in pooling resources,

emergency medical knowledge and early cooperation of all related specialties [2]. These EDs provide first aid and diagnostics in all medical disciplines that are represented in the hospital.

However, in contrast to many other European countries, neither doctors nor nurses are specifically trained for emergency work through a special training program, apart from local initiatives. There are plans to change this in the future [8]: beginning in 2017, there will be further education in emergency medicine for nursing professions [3]. As of February 2017, there are no graduates.

Pain is a major reason for patients to go to an emergency department. The proportion of patients who report pain as the main reason for their visit is estimated to be as high as 80%. [5,7,9]

As was shown in a 2015 study, sufficient pain management is the most important factor influencing patient satisfaction in the ED, ranking even higher than the quality of medical treatment, hygienic conditions or nursing care [11] (Figure 1). Sufficient management of pain is described as a core process in the ED [10].

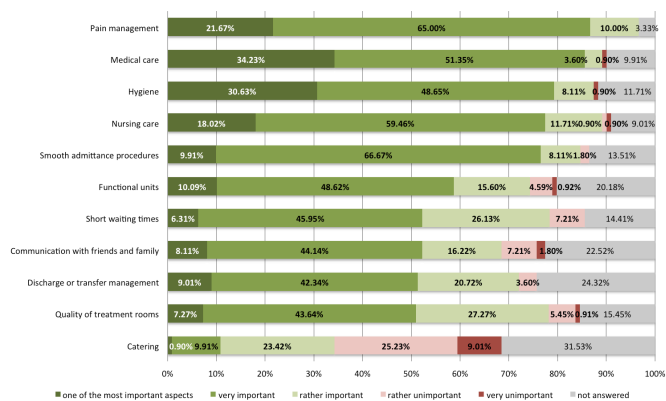


Figure 1. Specific dimensions of patient satisfaction in the ED [11].

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Despite this, there are no standard operating procedures (SOPs) or protocols for pain management across disciplines widely established in German EDs, unlike other Western European countries. Many German EDs do not have an effective, or any, pain management protocol in place [5].

A. Status Quo in the Examination Hospital

The examination hospital is a hospital of basic and regular care in Darmstadt, Hesse It has nearly 400 beds, most of them in the departments of Internal Medicine (103), General Surgery (46), Traumatology (46) and Psychiatry (108). In addition, there are some specialized units, such as an interdisciplinary Intensive Care Unit (ICU), a Center for Gastrointestinal Diseases, a Center for Palliative Medicine, a Center for Radiology, a Center for Anesthesia and Pain Therapy, a central reception for planned hospital admittances and an Emergency Department which is physically and organizationally separate. There is also coordination and cooperation with office-based physicians as well as with a hospice and a sleeping laboratory. Besides that, a medical care center and different specialist residents are connected to the hospital. In 2013, a total of 11,481 in-patient, 711 semi-stationary and 30,949 out-patient treatment cases were registered over all departments of the hospital.

Patients are admitted to the examination hospital via two physically and organizationally separate units: the central reception and the central emergency room. The central reception is attached to central patient management. From 7:00 am to 5:30 pm, all patients who are scheduled to be admitted to the hospital and have received an appointment in advance can be found here.

Since 2006, the Central Emergency Department has been available 24 hours a day as a central point of contact and coordination for emergencies of all kinds. Here, all emergency patients are recorded, examined, and diagnostics and first aid are provided. If necessary, inpatient admission, relocation to another hospital or dismissal also takes place. In the ED, an internist and a surgeon are always present, and a psychiatrist is on call. During the day, three nurses are present, with one nurse always assigned to nursing assessment and triage. At night, two nurses are present. In addition, the ED has an accreditation for occupational accidents and is a member of the regional trauma network as a trauma center. Furthermore, controls, such as gypsum or blood checks, are carried out on patients whose current treatment is complete or have been previously treated.

A pain management algorithm for postoperative patients was developed a few years ago has been used on the wards since then. Some time later, this SOP was also approved for use on patients in the ED.

Patients are surveyed on their level of pain as part of the nurses' triage process using a ten-point Numerical Rating Scale (NRS) in accordance with the Manchester Triage System [6]. However, the collected values have so far only been used for structured pain management in surgical patients. Pain reported at a score of 4 or higher on the NRS should be treated. Patients who report a pain score of 4-5 get a short infusion of Metamizole (or Paracetamol in cases of intolerance) and patients who report a pain score of 6 or higher receive a short

infusion of Piritramide or an oral dose of Oxycodone. The simplified scheme is shown in Figure 2.

	None	Tolerable, slightly			Rather bad, moderate			Very bad, severe			Worse than ever
	0	1	2	3	4	5	6	7	8	9	10
Surgical Patients		None			Metamizole i.v.			Piritramide i.v.			
Internal Patients		None			None			None			
Alternate Drug		None			Paracetamol i.v.			Oxycodone p.o.			

Figure 2. Simplified scheme of pain management before the intervention. Own illustration.

A former study on patients being treated in the ED of the same hospital showed that 69.0% of respondents (100 out of 155) across all departments reported pain (Figure 3). Of these, 79.7% reported acute pain and 15.9% reported chronic pain. 85.5% of patients named pain as the main reason for their visit to the emergency department. [9] The arithmetic mean (\bar{x}) of the average pain value before analgesic treatment across all departments was $\bar{x}=5.9$ on a ten point NRS (standard deviation, $SD=2.5$; median $\tilde{x}=6.0$ (internal medicine $\bar{x}=6.04$, $SD=2.36$, $\tilde{x}=6.0$; general surgery $\bar{x}=7.0$, $SD=3.56$, $\tilde{x}=7.5$; traumatology $\bar{x}=6.17$, $SD=2.25$, $\tilde{x}=6.0$). About a quarter of the patients who answered rated the pain relief as acceptable or poor (Figure 4).



Figure 3. Incidence of pain in the ED [9].

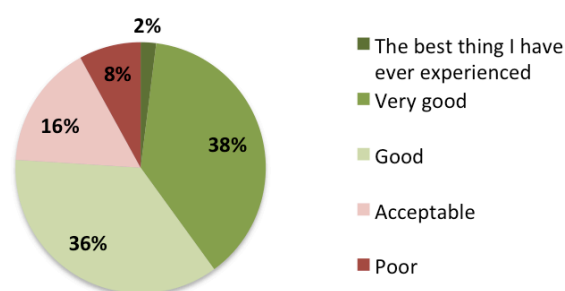


Figure 4. Effectiveness of pain relief [9].

These results are consistent with findings in the literature, which indicate an incidence of pain in EDs of about 70% [15]. Despite this, the phenomenon of pain in the emergency department as an interdisciplinary problem has so far been little researched, and there is still a lack of pain management SOP for use on internal medicine patients.

B. Planned Intervention

Due to the lack of a structured pain management system covering all patients treated in the ED of the examination hospital, the existing SOPs are to be expanded to include a special section for internal medicine patients.

In keeping with the already existing protocol, internal medicine patients who report a pain score of 4-5 will get a short infusion of Metamizole and/or Hyoscine butylbromide or Paracetamol and patients who report a pain score of six or higher will receive a short infusion of Piritramide or an oral dose of Oxycodone. The alternative drug remains the same for all patients. The revised, simplified scheme is shown in Figure 5.

	None	Tolerable, slightly			Rather bad, moderate			Very bad, severe			Worse than ever
	0	1	2	3	4	5	6	7	8	9	10
Surgical Patients	None				Metamizole i.v.			Piritramide i.v.			
Internal Patients					Metamizole i.v. and/or Hyoscine butylbromide						
Alternate Drug					Paracetamol i.v.						

Figure 5. Revised, simplified scheme of pain management after the intervention. Own illustration.

C. Hypothesis

Implementation of a structured, cross-departmental pain management system relieves patients' pain and increases patient satisfaction significantly. By expanding an already existing system, it is also easily adopted by staff.

II. AIM OF THE STUDY

To remedy the deficiency, a standardized and structured pain management system, developed by an interdisciplinary team of physicians, nurses, pharmacists and nurse researchers, is implemented in the examination hospital. This protocol enables all nurses to provide patients with adequate pain medication in a reasonable time when a physician is not immediately available. This reduces preventable suffering.

The implementation is studied with a view to answer the following research questions:

- Do patients benefit from structured pain management?
- Does its use increase patient satisfaction?
- Is it feasible and easy to use by staff?

III. METHODS

This is an empirical multi-method study with two specific focus groups. Both patients and staff in the ED of the examination hospital are asked to answer the previous questions. In preparation for this study, some provisions had to be made. These are shown below.

A. Study Designs

Due to ethical considerations, a between-subjects [4] design was chosen for the examination of patients. The results of a survey conducted prior to the intervention on structured pain management were compared to those of a survey conducted after the intervention. It was expected that the implementation of a pain management system would bring benefits to patients.

Therefore, randomization of the patients was ethically prohibited. A within-subjects design was unethical since it would artificially delay pain medication or urgent emergency treatment. However, in order not to jeopardize internal validity, similar samples were investigated over the same length of time. This procedure ensured that assumptions made in the research design could reasonably hold for both samples [4].

Patients were surveyed on their level of pain before and after application of pain management, on their wait time for application of pain management, on the efficiency of that intervention, and on their overall satisfaction with their treatment in the ED. Additionally, they were asked whether nurses and physicians cared for them immediately after they expressed pain.

The questionnaire contained yes/no questions, a pain NRS and ordinal scaled grades from one to six (one representing best and six representing worst).

A draft of the questionnaire was pretested in a small group of patients. It was then given to patients over a 14-day period during which no changes to the ED were made.

Afterwards the revised structured pain management system as described above was implemented. Time was needed to meet challenges of implementation (for example, training staff), and the second 14-day examination period started 6 months after the end of the first.

Table 1 shows a schematic representation of the design of this part of the study.

TABLE I. SCHEMATIC REPRESENTATION OF EXAMINATION OF ED'S PATIENTS

Group	Examination 1	Intervention	Examination 2
	Two weeks	Six months	Two weeks
Examination group 1	Survey 1	Intervention	-
Examination group 2	-		Survey 2

The employee representation did not allow us to collect data using a within-subjects design. A pre-test and post-test comparison was therefore not possible without compromising respondent anonymity, which was unacceptable to the researchers.

This is why a between-subjects design was chosen in surveying ED staff. The staff were surveyed before and after implementation of the pain management system [4] and the results of the two surveys were compared, in order to obtain additional information on the applicability and benefit of the intervention.

It was ensured that the number of staff did not change over the investigation period, in order not to endanger the findings of the study.

Staff in the ED consists mainly of nurses and physicians. For this reason, both groups were asked their opinion on the structured pain management system before and after intervention. They were surveyed on the system's practicability, efficiency, duration until effects, legal certainty,

handling security, and the extent to which their workload was relieved due to its use.

The questionnaire contained yes/no questions, a pain NRS and ordinal scaled grades from one to six (one representing best and six representing worst).

A draft of the questionnaire was pretested in a small group of staff. It was then given to staff in the 14 day period before the revised pain management system was implemented.

Table 2 shows a schematic representation of the design of this part of the study.

TABLE II. SCHEMATIC REPRESENTATION OF THE EXAMINATION ON ED'S STAFF

Group	Examination 1	Intervention	Examination 2
	Two weeks	Six months	Two weeks
Staff in the ED	Survey 1	Intervention	-
	-		Survey 2

B. Ethical Considerations and Data Collection

Informed consent was required in both groups, patients and staff, to participate in this survey. All participants were assured that they would not face any negative consequences if they did not participate. A phone number was provided for any queries they might have, as well as a detailed explanatory note. The anonymity of the participants was ensured at all times. To ensure this, neither gender nor age were recorded by the staff in conducting the survey. Management of the hospital had no access to the raw data at any time. They were evaluated exclusively at the university.

To avoid placing additional stress on acutely ill patients, and to avoid the possibility of the setting negatively affecting the results, the survey was conducted the day after patients were admitted. Inpatients who met the following preconditions were surveyed: their treatment was provided by one of the somatic disciplines, such as internal medicine, general surgery or traumatology, they were not admitted to a palliative or intensive care unit, and they were not disoriented, confused or suffering from dementia. Furthermore, no children under the age of 14 or patients with limited knowledge of the German language were included.

The staff received the questionnaires, which were addressed to them, together with their salary statement.

Answered questionnaires were sent back to the researchers in envelopes via the house mail, requiring no postage.

C. Conflict of Interests

Patrick Ristau and Stephanie Pfeuffer both declare that there are no conflicts of interest.

D. Methods of Analysis

Due to the applied study design, the researchers selected a descriptive preparation and a subsequent comparison of the collected data from the various study groups. The mean values (\bar{x}), standard deviations (SD) and medians (\tilde{x}) were usually calculated. Microsoft Excel for Mac 2011 version 14.5 was

used for these calculations. Selected results were also graphically prepared and/or summarized in tables for the sake of clarity.

E. Setting and Participants

As mentioned above, the examination hospital is a hospital of basic and regular care in Darmstadt, Hessen. Patients, nurses and doctors from the somatic departments were the target group of this study.

Only patients who were admitted to hospital, who met the inclusion criteria as described above and who were treated by one of the three somatic specialist departments (internal medicine, general surgery, and traumatology) were surveyed.

All doctors and nurses employed in the emergency room were interviewed.

IV. RESULTS

The results of the study are presented and discussed in detail in the following section of this paper. The respondent groups will be described epidemiologically. The questions posed in this study will then be answered in sequence.

A. Sample Characteristics

The sample characteristics are further shown for both groups of patients and staff in Tables 3 and 4. Additionally, p-values were calculated. There were no significant differences between those examination groups in their epidemiological characteristics. As can be seen from the tables, the groups do not differ significantly.

TABLE III. DISTRIBUTION OF DEMOGRAPHIC VARIABLES AMONG PATIENTS WHICH WERE TREATED IN THE ED

Demographic Variables	Examination Group 1 (n=130)		Examination Group 2 (n=137)			
	No.	%	No.	SD	\tilde{x}	
Return	83	63.85%	76		55.47%	
Gender						
Male	33	39.76%	33		43.42%	
Female	39	46.99%	32		42.11%	
Patients Suffering Pain	54	65.06%	39		51.32%	
	\bar{x}	SD	\tilde{x}	\bar{x}	SD	\tilde{x}
Age	56.6	20.4	59.0	61.5	18.9	62.0

TABLE IV. DISTRIBUTION OF DEMOGRAPHIC VARIABLES AMONG STAFF EMPLOYED IN THE ED

Demographic Variables	Examination Group 1 (n=88)		Examination Group 2 (n=87)	
	No.	%	No.	%
Return	28	31.82%	22	25.29%
Profession				
Physician	13	46.43%	7	31.81%
Nurse	11	39.29%	9	40.91%

Demographic Variables	Examination Group 1 (n=88)			Examination Group 2 (n=87)		
	No.	%		No.	%	
Others	3	10.71%		5	22.73%	
	\bar{x}	SD	\tilde{x}	\bar{x}	SD	\tilde{x}
Period of Employment	6.3 a	6.2	5.5	5.7 a	4.9	5.5
Weekly Working Hours	21.5 h	13.7	17.5	23.7 h	13.8	24.0

B. How patients benefit from the use of an interdisciplinary pain management

Structured pain management was used in 55.5% of cases before revision, and in 69.2% of cases after it. This represents an improvement of 13.7% (Figure 6).

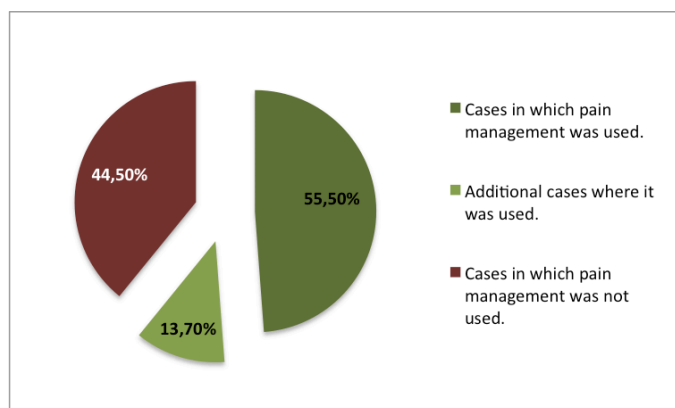


Figure 6. Cases in which pain management was used after revision of structured pain management.

Through the consistent use of structured pain management, patients' perceived pain was reduced from 6.84 (SD=2.39, \tilde{x} =7.0) on average before treatment to 4.04 (SD=2.47, \tilde{x} =3.0) after treatment. This corresponds to an average relief of -2.8 (SD=2.0, \tilde{x} =2.0) on a ten point NRS (Figure 7).

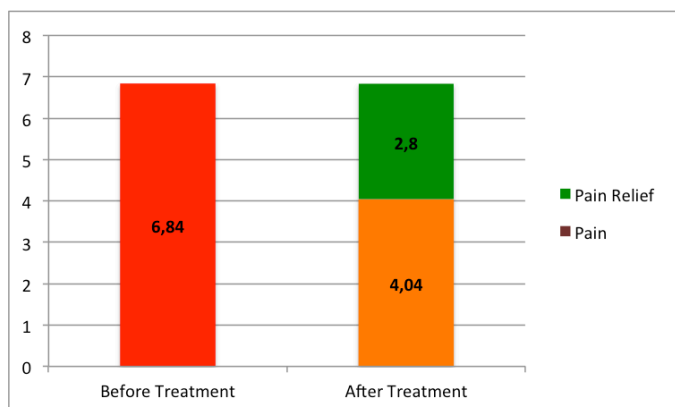


Figure 7. Overall pain relief before and after pain treatment on a ten point NRS.

The waiting time to receive pain-managing treatment from a nurse improved from an average of 13:40 minutes before revision to an average of 12:35 minutes afterwards. Also, the

waiting times to see a doctor improved from an average of 17:20 minutes before revision to 14:39 minutes afterwards.

Patients indicated before the revision that when they expressed pain, in 36.1% of cases they were immediately helped by a nurse and in 30.8% of cases they were immediately helped by a doctor. After training the staff on the revised structured pain management system, 82.0% of patients indicated that they were immediately helped by a nurse and 74.4% indicated that they were immediately helped by a doctor. This corresponds to an improvement of 45.9% and 43.6% respectively (Figure 8).

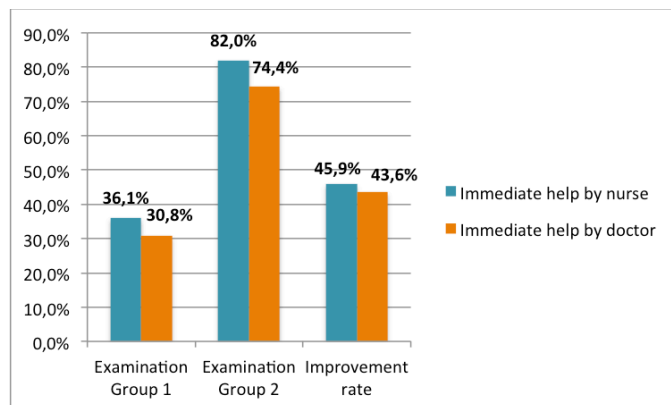


Figure 8. Quotas of cases in which immediate help was received when patients expressed pain.

C. How patient satisfaction is increased when an interdisciplinary pain management is installed

Patients described the effectiveness of pain relief before the implementation with a value of 2.42 (SD=1.29, \tilde{x} =2.0) and after the implementation with a value of 2.03 (SD=1.06, \tilde{x} =2.0). Thus, there is an improvement of 0.39 points. These results are illustrated in Figure 9.

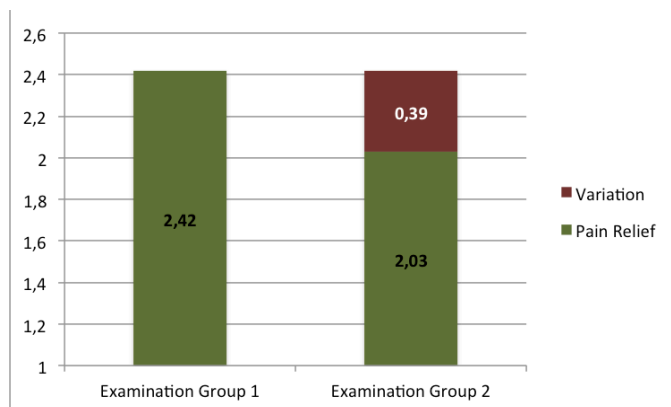


Figure 9. Pain relief before and after implementation of a structured pain management, rated by patients.

Furthermore, the overall satisfaction with treatment in the emergency room increased after the introduction of structured pain management from 2.2 to 1.69 by 0.51, which is almost half a school grade. This development is shown in Figure 10.

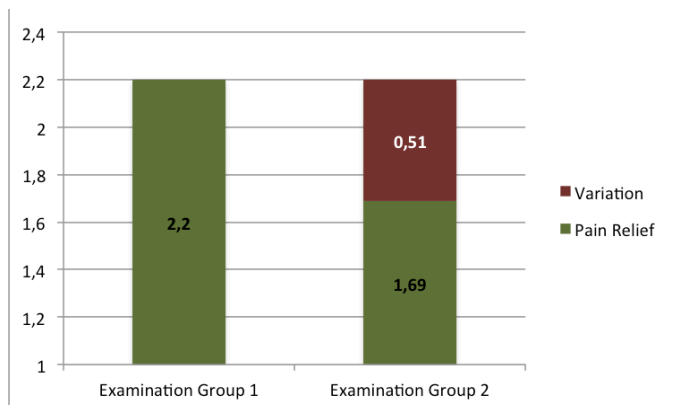


Figure 10. Patient satisfaction in the context of the implementation.

D. Review of staff of the ED on structured pain management

The staff in the emergency department of the examination hospital rated the effectiveness of pain relief at 2.52 (SD=0.92, \bar{x} =2.0) before the revision. After the revision, they rated it at 2.12 (SD=0.86, \bar{x} =2.0), which corresponds to an improvement of 0.40 on the scale (Figure 11).

The applicability was previously rated at 2.54 (SD=1.02, \bar{x} =2.0) and later at 2.29 (SD=0.85, \bar{x} =2.0). This is an increase of 0.25.

Asked about the legal and operational safety of the application, the staff assessed the pain management before the intervention at an average of 2.8 (SD=1.0, \bar{x} =3.0) and after the intervention at 2.76 (SD=1.48, \bar{x} =3.0). No major changes were expected in this due to the fact that this intervention was merely an extension of an already existing concept.

The rapid response was indicated before the implementation at 2.6 (SD=0.81, \bar{x} =3.0) and afterwards at 2.24 (SD=0.90, \bar{x} =2.0). This represents an improvement of 0.36 (Figure 12).

The staff answered the question of whether the existing pain management system facilitated their work with 2.64 (SD=0.95, \bar{x} =2.0) before and 2.11 (SD=1.21, \bar{x} =2.0) after the improvement. This corresponds to the improvement of 0.53, more than a half school grade (Figure 13).

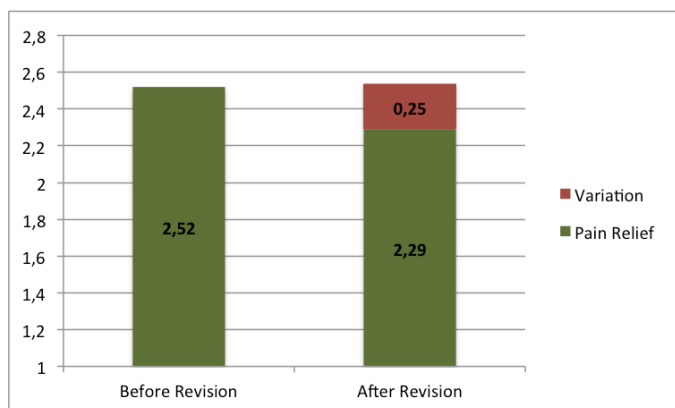


Figure 11. Pain relief rated by staff.

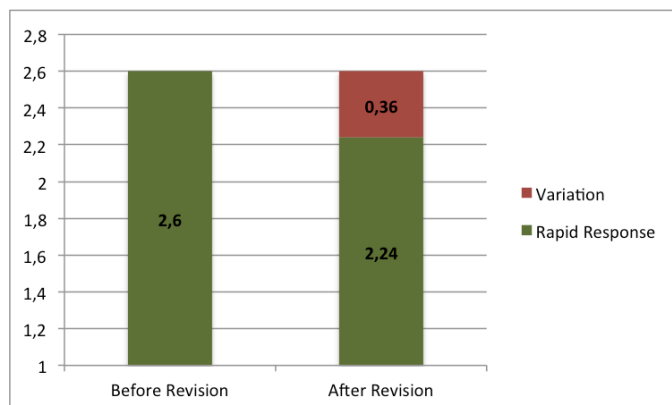


Figure 12. Rapid response of structured pain management rated by staff.

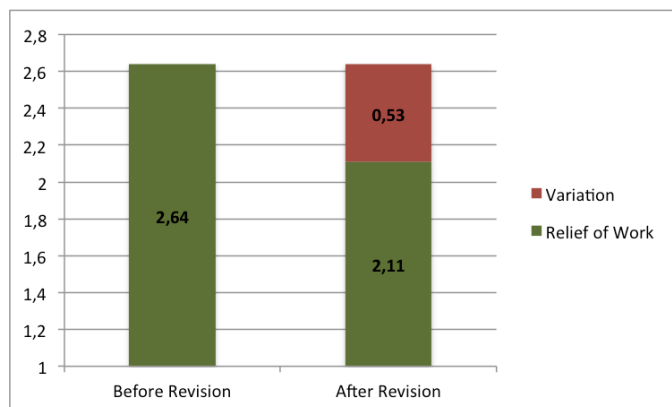


Figure 13. Relief of work for ED's staff due to structured pain management.

V. DISCUSSION

This investigation has yielded some very good results. It has shown that pain can be effectively reduced, waiting times for painkillers lowered and patient satisfaction increased. In addition, a considerable reduction in the workload of staff can be achieved if they use the pain management system.

Unfortunately, statistical significance could not be shown, probably due to the small samples. However, many of the results show a trend towards significance with p-values close to .10. For a subsequent follow-up investigation, higher numbers of cases should therefore be sought. This will allow analysis of subgroups which could not be carried out in this study. An on-scene observation with additional staff would also be worthwhile. Nevertheless, in this study effectiveness could be demonstrated in all areas of interest, so that the hypotheses presented could be confirmed.

Some questionnaires showed huge individual differences regarding specific aspects, such as extraordinarily long waiting times for pain intervention, negatively affecting the average values. It also seems some physicians and nurses do not apply structured pain management adequately, whether because of lack of knowledge or another reason. There may be a link between these two circumstances. If the study had filtered out bad records, significant results probably could have been achieved.

The measuring instruments used can and should be reused in a similarly designed follow-up examination. A special focus

should be on the examination periods, which should be as similar as possible to each other, e.g. without public holidays. Unfortunately, this could not be taken into account in the present study due to time constraints. With such an investigation, the results presented here could be developed into a statistical proof of effectiveness.

The cooperation between the Protestant University of Applied Sciences Darmstadt and the examination hospital presented here is, so far, rather unusual for German Universities of Applied Sciences, but should be maintained and intensified in the future. This type of cooperation can be seen as an example of good practice for application-oriented, interdisciplinary nursing research. It would be desirable if this research projects were to be financially and logistically supported by public and private donors and health insurance funds.

VI. CONCLUSIONS

After doctors, nurses are the second major professional group directly involved in patient care within the hospital. Adequate interprofessional and interdisciplinary action is therefore imperative for adequate and satisfactory care in emergency departments. It is prudent to take this into account, paying special attention to implementing a sufficient pain management system, in future hospital planning and process designing, especially of central emergency departments.

As has been shown, a structured pain management system is a sensible supplement to the nursing assessment. It should, where appropriate, be applied, as it is effective, reduces unnecessary suffering and increases patient satisfaction. It also reduces staff workload, slowing more time to be spent on patient care. This leaves more time for specialists in the emergency room to look after the individual needs of the patient.

Additionally, there is a need to train staff on a regular basis. This helps to achieve even better results for patients.

However, in the midst of these highly positive and encouraging results, it should not be forgotten that a patient-oriented process design in the emergency department requires continuous improvement. The focus of process optimization should always be on the main stakeholders.

After all, it is the patient who is at the center of all our labor.

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AUTHORS' PROFILE

Patrick Ristau, B.A., is a paramedic and teaches in a professional school. He finished his bachelor's studies in nursing and health promotion at the Protestant University of Applied Sciences Darmstadt in 2015 and is currently a student of the master programme in nursing sciences. His particular interest is the interface between preclinical and clinical care as well as the topics of ethical principles in patient care and quality management in health care facilities. He works together with Dr. Pfeuffer in this research project.

Stephanie Pfeuffer, Ph.D., is a pharmacist and researcher at the Protestant University of Applied Sciences Darmstadt, Germany. The Johannes Gutenberg University in Mainz awarded her a doctorate in pharmaceutical chemistry. Later, she was appointed to a deputy professorship of the medical fundamentals of nursing science. Her research focusses on interprofessional cooperation in health care and polypharmacy in retirement homes. In this context, Dr. Stephanie Pfeuffer holds the scientific management of the research project presented here.