Discharge Communication in the Emergency Department: On Quantity- and Content-Definition and on the Benefit of Information Structuring

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Declaration

I, Selina Ackermann, born on January 27, 1986 in Basel, Switzerland, hereby declare the following:

(i) My cumulative dissertation is based on four manuscripts, of which one is published (Ackermann, Bingisser, Heierle, Langewitz, Hertwig, & Bingisser, 2012), two are in press (Ackermann, Heierle, Bingisser, Hertwig, Padiyath, Nickel, Langewitz & Bingisser, 2014), and (Langewitz, Ackermann, Heierle, Hertwig, Ghanim & Bingisser, 2015), and one is submitted (Ackermann, Ghanim, Heierle, Hertwig, Langewitz, Mata & Bingisser, 2015). I contributed to these manuscripts in the following way:

1. Ackermann, Bingisser, Heierle, Langewitz, Hertwig & Bingisser (2012): Jointly responsible for the development of the idea. Primarily responsible for data collection, analysis and writing of the paper.

2. Ackermann, Heierle, Bingisser, Hertwig, Padiyath, Nickel, Langewitz & Bingisser (2014): Jointly responsible for the idea. Primarily responsible for the data collection, analysis and writing of the paper.

3. Langewitz, Ackermann, Heierle, Hertwig, Ghanim & Bingisser (2015): Jointly responsible for the idea and the experimental paradigm. Primarily responsible for the data collection and analysis. Partially responsible for writing of the paper.

4. Ackermann, Ghanim, Heierle, Hertwig, Langewitz, Mata & Bingisser (2015): Jointly responsible for the idea and the experimental paradigm. Primarily responsible for the data collection, analysis and writing of the paper.

(ii) I only used the resources indicated.

(iii) I marked all the citations.

Menlo Park, February 8, 2015

Selina Ackermann

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Abstract

Health and diseases have always accompanied humans and are important topics to talk about. Appropriate communication, however, can only have an impact on one's health if the essential content is transferred and if the message is sent in a way enabling the receiver to understand and recall it. Therefore, this cumulative dissertation has been realized to conduct four studies focusing on the quantity and content of information conveyed from the physician to the patient in the emergency department as perceived by both parties involved and in this context on the benefit of information structuring on the receiver's subsequent recall capacity.

Through the *preliminary study*, we could show that physicians from different specialties defined a large number of items as necessary to be given to a patient with chest pain at discharge from the emergency department. *Study 1* revealed that physicians and patients strongly overlap in their assessment of what ought to be conveyed in a discharge communication: Nearly all items identified by the majority of physicians as important were also endorsed by the majority of patients. Three expert physicians classified the items chosen by the two groups into five exclusive categories, namely "Information on diagnosis", "Follow-up suggestions", "Advices on self-care", "Red flags", and "complete Treatment", from which we generated the mnemonic acronym "InFARcT".

As experimentally tested in *study 2* (using students as proxy patients), information structuring proofed to be beneficial in terms of the recall capacity of students with little to no prior medical knowledge: students in the structured condition recalled mean 8.12 items, whereas students in the non-structured condition recalled mean 5.71 items ($p=0.004$). Assuming that structure should benefit mostly those individuals who cannot make use of previous knowledge to build memory chunks and to better control the experimental setup between the two parameters "structure" and "prior knowledge", we set out to oppose various degrees of relevant prior knowledge to structured and non-structured content presentation in

study 3, with the following results: prior medical knowledge boosted recall performance – the group of students with the least prior knowledge recalled fewer items (M=7.11) than the group of students with intermediate prior knowledge (M=9.49), who in turn recalled fewer items than the group of students with most prior knowledge (M=13.23). Furthermore, the magnitude of the effects of information structuring seems to vary systematically by the degree of medical knowledge: It is greatest with least prior knowledge, and disappears gradually with increasing expertise.

We conclude that there is an obvious need to train physicians in skills of implementing effective discharge communication, in content and form, as this represents a valuable and rare opportunity to communicate, and thereby to foster better outcomes. It should not go to waste.

Contents

1. General Introduction

Health and diseases have always accompanied humans. Being healthy remains a key goal for mostly everyone, although the diseases that people suffer from may have changed over time. Health and disease, therefore, are important topics to talk about for humans all over the world. However, appropriate communication can only have an impact on one's health if the essential content is transferred and if the message is sent in a way enabling the receiver to understand and recall it. Therefore, this dissertation has been realized to conduct studies focusing on the quantity and content of information conveyed from the physician to the patient in the emergency department (ED) as perceived by both parties involved and in this context on the effect of a certain communication technique on the receiver's subsequent recall capacity.

In an ED, effective communication represents a major step in medical care, with the potential to improve patients' well-being and satisfaction, adherence to medication, and, in the end, better outcomes. A key opportunity for emergency physicians to inform and teach patients occurs during the discharge process. However, the efficiency of this physician-patient interaction could be hampered by several bounds: The limited time in emergency care, the transfer of inappropriate content, and patients' mind's limited capacity to encode, store and maintain information. However, little is known about the specifics of physicians' and patients' agendas of the integral components of such communications and about ways to render them suchlike to improve patients' memory of it. Therefore, our specific aims were (1) to examine the number of items physicians deem crucial in an ED-discharge communication and the time estimated to be necessary presenting them (preliminary study), (2) to assess physicians' and patients' goals concerning such communications (study 1), (3) to test the potential of ED discharge information structuring (based on the results of the preceding studies) in benefiting subsequent recall capacity (study 2), and to assess whether the

magnitude of the effects of information structuring varies by the degree of medical knowledge (study 3).

This general introduction will give an overview on the topic and is structured as follows: first, the general relevance of effective physician-patient-communication will be presented (1.1.). Subsequent, the ED-discharge process will be described and the reasons why communication in the ED-setting (1.2.) and particularly at discharge (1.3.) is potentially challenging are demonstrated. An overview of previous research on information structuring is provided (1.4.) and finally, the rationale for this research project will be pointed out (1.5.).

1.1. The Importance of Investigating Physician-Patient-Communication

Effective communication is an essential component of quality health care that is attracting increasing research attention (Ong, de Haes, Hoos, & Lammes, 1995). Empowering patients through education and knowledge allows them to take an active, participative role in partnering with healthcare providers (Spath, 2004). According to a recently published review on physician-patient-communication (Ha & Longnecker, 2010), many barriers to good communication exist: deterioration of physician's communication skills, nondisclosure of crucial information, physicians' avoidance behavior (in terms of neglecting topics in case of inability to handle these issues or lack of time to do so adequately), discouragement of collaboration, and various resistances by patients.

Physician-patient-communication about diagnosis, prognosis, and preferences for care is critical in enabling patients to adequately prepare and plan. Furthermore, it has the potential to help regulate patients' emotions, facilitate comprehension of medical information, and allow for better identification of patients' needs, perceptions, and expectations (N. K. Arora, 2003; Brédart, Bouleuc, & Dolbeault, 2005; Platt & Keating, 2007). Insufficient communication has been shown to result in patient dissatisfaction, reduced compliance,

poorer health outcomes, more litigation, increased demand on health resources, and stressed physicians (Little et al., 2001; Razavi & Delvaux, 1997). However, various significant gaps in communication between patients and health care professionals exist (Stewart, 1995). Investigating the communication between physicians and patients can therefore help to optimize healthcare provision, for instance by identifying specific training needs for physicians in techniques that enable them to more adequately transfer information.

1.2. Communication Challenges in the Emergency Department

The practice of emergency medicine is characterized by episodic contact with patients and difficulties in establishing continuous care (Logan, Schwab, Salomone, & Watson, 1996). Physicians working in the ED face numerous challenges, such as working in a chaotic environment and treating mentally or chronically ill patients that impact ED communication, which is also constrained by stress and the time-sensitive nature of many cases (Dean & Oetzel, 2014). On the other hand, patients arrive in the ED with various amounts of information, experience with the healthcare system, language fluency, and health literacy (Samuels-Kalow, Stack, & Porter, 2012). As stated above, communication between physicians and patients has a challenging nature. However, communication during times of stress is often awkward and difficult. Consequently, several factors were identified to make communication in the ED even more challenging, including unpredictable workload, ED crowding, simultaneous care for multiple patients, high level of uncertainty, time constraints, absence of long-term relationship with patients, and lack of feedback about outcomes of care (Eisenberg et al., 2005).

In a previous study, ED residents were found to devote far more time and attention to the collection of information than to information giving, suggesting that the latter goal receives less attention (Rhodes et al., 2004). Consequently, a precious opportunity may be missed during which physicians could effectively recapitulate the results of the evaluation in

the ED, spell out the final working diagnosis, and recommend follow-up and treatment options (Vashi & Rhodes, 2010). As time is a limited resource in hospitals in general and in EDs in particular, sharing information with patients will inevitably be traded-off with the time requirements of other tasks (Scott, Watson, & Ross, 2003). Time, however, is not the only constraint. Human working memory is limited in the number of items it can hold. In his landmark publication, Miller (1956) found that humans can recall only seven plus/minus two chunks of information. Several factors may contribute to even lower memory capacity - Cowan (2001) described the "magic four" chunks recalled in a more complex type of memory experiment which is more likely to be representative of the situation in which ED patients find themselves.

These aggravating circumstances contribute to the challenges that ED-physicians face when communicating with a patient. Furthermore, they highlight the need of research in this field; especially as crowding is a frequent and pervasive phenomenon for the majority of EDs around the world (Hoot & Aronsky, 2008).

1.3. Communication Challenges at Discharge

Although the common understanding is that hospital care has concluded upon discharge, leaving the acute care setting is more accurately the beginning of a process of recovery. Hospital discharge can be a time of significant patient dissatisfaction, as patients are transitioning to a new environment and are expected to understand and recall complex instructions despite not feeling well and being under stress (Dudas, Bookwalter, Kerr, & Pantilat, 2002). Transition out of the hospital is a vulnerable time for patients and their families. More than 20% of patients experience an adverse clinical event within 30 days of discharge from the hospital (Forster et al., 2004).

Compounding these risks, deficits in communication and information transfer at hospital discharge are common and may adversely affect patient care (Kripalani, LeFevre, et

al., 2007). Effective physician-patient-communication at discharge - that is, communication which enables patients to understand and recall medical information - is therefore a crucial aspect of patient care that can lead to improved patient outcomes, including higher patient satisfaction (Kessels, 2003), better adherence to medication (Cameron, 1996; Kessels, 2003), more adequate disease management (Galloway et al., 1997), and reduced anxiety (Mossman, Boudioni, & Slevin, 1999). Unfortunately, effective discharge communication appears to be the exception rather than the rule: Even in immune-compromised patients, for whom knowledge of medication is crucial to treatment success, knowledge of recommendations at discharge is merely moderate (Chau et al., 2011).

Discharge from the ED in particular is a period of high vulnerability for patients (Samuels-Kalow et al., 2012); they might encounter an increased risk for further clinical deterioration, suffer from a misdiagnosis in case of a non-exhaustive diagnostic process, or experience side effects from newly installed drugs (Kripalani, Jackson, Schnipper, & Coleman, 2007). The ED-discharge process is complex and involves care judgment and decision making. Emergency physicians play a key role in facilitating continuity of care and as a link to the primary care provider (Kripalani, Jackson, et al., 2007; Villanueva, 2010).

Obviously, there is a need to recognize that the responsibility for the patient does not end at the termination of the hospital stay and that timely and effective communication and certain standardization of communication can be improved upon for all patients at the time of transition out of the hospital but even more so for patients who are medically complex with multiple comorbid conditions, for example for patients with chest pain.

1.4. Information Structuring and the Role of Prior Knowledge

How could the content of physician-patient-communications at discharge be delivered in order to improve patients' understanding and recall and, in the end, his or her outcome? Systematic literature reviews suggest a number of possible interventions that may improve

discharge communication (Samuels-Kalow et al., 2012; Watson & McKinstry, 2009). Samuels-Kalow et al. (2012) recommend that communication should (a) be standardized, (b) adapted to the patient's knowledge and language, (c) include comprehension checks and (d) involve patient reminders or help with follow-up appointments. One way to standardize communication is to provide written information (Johnson & Sandford, 2005); however, this is not always possible when information needs to be tailored to a specific patient, patient literacy is low, or the diagnosis is unclear. A more feasible alternative could be to ensure that oral communication adheres to certain structural characteristics.

In written material, structure is imposed in the way content is presented sequentially. For instance, in newspapers, headlines precede the main text and are easy to identify; they announce the topic elaborate on in the text. Books use even more sophisticated structural elements to guide readers through content: title, table of contents, chapter headings, text, reference list, etc. In the communication skills training for medical students at the University of Basel, the term "book metaphor" is used to help participants understand, appreciate, and remember the value and function of structuring information in specific order - advancing from summary, high-level information (e.g., title, table of contents, chapter headings) to detailed, low-level information (e.g., text, annexes) (Kiessling & Langewitz, 2013).

Psychological theory and associated empirical findings suggest that information structuring can be a powerful tool in improving recall and understanding. In a seminal study investigating the influence of structure on learning, Epstein (1967) showed that verbally structured material was better learned and later recalled than unstructured material. Another study demonstrated that healthy students' (but not process schizophrenics') accuracy of recall was higher for a word list presented in structured than in unstructured order (Traupmann, 1975). A study investigating the effect of students' ability and type of instructional program (structured vs. unstructured) on performance in easy and difficult test items showed that high- and medium-ability students performed better in the structured program (Hannafin, 2004).

Meta-analyses on the use of a specific type of information structuring, namely, advance organizers - i.e., information presented by an instructor prior to learning with the goal of helping the learner organize new incoming information - suggest that structure can indeed assist learning: Hattie (2009) estimated an overall positive effect size of .4 on learning from 11 meta-analysis of 577 studies (N = 3905). One likely psychological mechanism underlying the benefits of information structuring appears to be chunking, that is, the association of disparate low-level individual elements into large high-level clusters (Miller, 1956). Indeed, the ability to form high-level clusters has been directly linked to increases in recall capacity, making it a useful tool for memorizing large amounts of information (Chen & Cowan, 2005; Gobet et al., 2001; Li et al., 2013).

How the structure implied by prior knowledge affects memory performance has been studied frequently in research on human memory (Bartlett, 1932; Bellezza & Bower, 1981; Bransford & Johnson, 1972; Craik & Tulving, 1975). A recent review concluded the following: "Prior knowledge facilitates processing of new incoming information, supposedly because it provides a structure into which the new information can be integrated, which may lead to an elaborated memory trace" (Brod, Werkle-Bergner, & Shing, 2013). When there is no internal structure because of lack of prior knowledge, externally imposed structure may yield similar memory benefits. The extent to which structuring the presentation of discharge information may improve patients' ability to recall that information and how such benefits may interact with the presence or absence of relevant prior knowledge has not yet been systematically examined.

1.5. Rationale and Aims for this Research

Highlighted by the aforementioned findings, effective communication at discharge from the ED is an important issue and indicator of quality of health care. Communication gaps upon ED discharge contribute to many of the preventable adverse events and

readmissions. Unfortunately, there is no evidence-based protocol concerning the quantity and the content of information physicians should aim to convey to patients. Therefore, the **preliminary study** conducted in the context of this dissertation takes a step into examining the attributes of good discharge communication. One component of better communication is for physicians to be well aware of the amount of information that can realistically be conveyed within an available time window. If so, they might select the necessary, inevitable information rather than striving towards the goal of fully inform the patient, with the general practitioner in mind, with whom the patient will connect after discharge and who probably is in better position to manage patients' information and therapy needs in the longer run (Cooley, McAllister, Sherrieb, & Kuhlthau, 2009). In order to examine the extent to which physicians are well calibrated to the amount of information and time needed, we first undertook a preliminary study that probed the number of crucial items physicians, in theory, aimed to cover in a typical discharge communication (with a patient who came to the ED because of chest pain) and the time required to, in reality, do so.

An important component of the medical care received during a care transition such as the discharge from the ED is the transfer and understanding of adequate, effective instructions from the physician to the patient. There are various ways to render discharge communication more effective, such as using tools (Jones & Mountain, 2009), improving communication skills (Langewitz, Eich, Kiss, & Wössmer, 1998), and defining the ideal content, which has rarely been attempted. Thus, besides the amount of an appropriate ED discharge communication, its effective content is also attracting our attention. To date, there is limited empirical basis for ED-physicians to decide which information is essential and must be given to patients to keep them well-informed or at least to avoid harm. From the patient's perspective a definition of crucial information would also be highly needed. As two parties are involved in such communications, namely the sender (physician) and the receiver (patient), our aim was to examine both patients' and physicians' views of the ideal content of

a discharge communication. In the past, very little research has been conducted on the perceptions of both patients and their physicians in relation to the discharge experience (Hancock et al., 2003). Interestingly, the patient is viewed more as an outsider to the system. Therefore, and due to his (usually) lack of educational background on the topic of such communications, one could assume patients also lack an understanding of its important content and would offer little if any insight into solutions. However, patients, as "outsiders" to the healthcare system, might develop unique perspectives of their care as they receive healthcare. Concerning communication, patients could have different views of the essential content than do physicians because patients experience and understand communication issues differently from those within the healthcare system. Precisely because they have little if any professional background, patients could discern communication gaps which physicians within the system may miss. To our knowledge, however, no previous study has assessed both physicians' and affected patients' informational preferences in ED discharge communication, and the extent to which both parties' preferences converge, which has been the main purpose of the present **study 1**. Our goal was to implement a new method for content definition, using the example of chest pain, one of the most frequent complaints in the ED.

However essential the transferred information at discharge might be, it can only have a positive effect on the patient if he or she recalls its content after discharge. Little is known about patients' ability to subsequently recall instructions received during hospital discharge (Sanderson, Thompson, Brown, Tucker, & Bittner, 2009). Using telephone interviews to gauge the ability to recall discharge instructions, Sanderson et al. (2009) found that many patients were unable to even name their diagnosis or list risk factors as contributing causes. Examining elderly patients' comprehension of discharge instructions, a further study found that 21% did not understand their diagnosis, and 56% failed to comprehend their return instructions (Hastings et al., 2011). A study of Chau et al. (2011) showed that even immune-compromised patient's knowledge of oral drugs at discharge was merely moderate. Finally,

Isaacman et al. (1992) observed that less than half of the important discharge information, including medication details and indicators of worsening of the patient's clinical status, was recalled during an exit interview. These few available findings suggest that there is ample room for discharge communication to be optimized and for finding and testing techniques to do so. As psychological theory and associated empirical findings suggest that information structuring can be a powerful tool in improving memory recall and understanding, the question has been raised whether structuring the information conveyed during the discharge communication could also improve patients' memory of the respective content. Few researchers (Doak, Doak, Friedell, & Meade, 1998; Ley, 1979) have suggested that structuring communications in a clinical setting could improve patients' recall. They argue that structured information would be easier to recall than non-structured information; however, these authors did not provide strong evidence to support this hypothesis. Furthermore, structured approaches and tools may provide support for physicians in increasing communication competences and potential solutions to improve the quality of communication and prevent subsequent patient harm. To date, only a few attempts have been made to investigate whether conveying information in a structured way results in better outcomes, measured in terms of learning and recall. The power of information structuring and associated chunking mechanisms has primarily been studied in the laboratory; no previous studies have investigated its role in improving discharge information delivery. Could information structuring also improve patients' recall and understanding of discharge information? If so, how should physicians best structure information at discharge to achieve these goals? How do possible effects on patients' recall translate to better adherence to recommendations? Studying these questions experimentally in the ED would be demanding and potentially stressful for ED patients. In a first step, we therefore decided to take advantage of students as proxy patients. Various previous studies have used proxies (mostly health care professionals or family caregivers) to evaluate certain patient outcomes (such as

health-related quality of life (Pickard & Knight, 2005), functional ability (Loewenstein et al., 2001), or symptoms (Nekolaichuk et al., 1999)). To our knowledge no previous study has used students as proxies to gauge the recall performance of patients.

Assuming that externally imposed structure yields benefits in terms of memory performance if internal structure is unavailable, the goal of **study 2** performed within this project was to investigate whether *first year psychology students*, i.e. students with little to no prior medical knowledge, who served as surrogate patients, recalled more information when it was presented in a structured way according to the aforementioned "book metaphor" as compared to a non-structured presentation.

Assuming that structure should benefit mostly those individuals who cannot make use of previous knowledge to build memory chunks and in order to better control the experimental setup between the two parameters "structure" and "prior medical knowledge", we set out to oppose various degrees of relevant prior medical knowledge to structured and non-structured content presentation, respectively. Prior knowledge facilitates the processing of new incoming information by providing a structure into which new information can be integrated (Brod et al., 2013); therefore, structured incoming information should not be recalled better than non-structured information by individuals who can build upon prior knowledge. If there is, by contrast, no internal structure because of absent prior knowledge, externally imposed structure could yield similar benefits. Thus, the extent to which the possible superiority of a structured presentation of ED discharge information over a non-structured presentation relates to relevant prior medical knowledge was assessed through **study 3**. Or, in other words, could the availability of relevant prior knowledge enable the receiver of information to store it efficiently, even when its presentation lacks structure? To answer this question, we recruited, besides the *first year psychology students* enrolled in study 2, two additional independent populations, namely *first year medical students* and *third year medical students*. Specifically, the three participant groups differed notably in their

knowledge of cardiac pain (*first year psychology students < first year medical students < third year medical students*).

The following chapters 2-5 describe methods and results of the four studies that were conducted during this dissertation project in detail. Chapter 6 addresses an overall discussion of the findings gained through this project and chapter 7 finally provides conclusions.

2. Preliminary Study

Outline

This is a modified part (methods and results) of a manuscript published in June 2012 in the Journal "Swiss Medical Weekly" (see annex) with the title

Discharge Communication in the Emergency Department: Physicians Underestimate the Time Needed

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2.1. Methods

2.1.1. Pilot Study. The preliminary study was initiated by a pilot study that was conducted to determine the time taken by emergency physicians for communicating information at discharge. To this end, real episodes of discharge communication were recorded. Each physician was instructed that the respective episode was to be analyzed for content; they were not told that time used was also of concern. Having received informed consent from patients and physicians, recordings were transcribed and in fact analyzed for the time used. Averaged across 20 episodes involving patients presenting with acute chest pain, discharge communication took six minutes. We therefore decided to use the 95% percentile of the distribution of interview times and defined the time limit for the main investigation as 15 minutes.

2.1.2. Setting and Procedure. The preliminary study was conducted in a quiet conference room at the University Hospital of Basel, Switzerland, an urban 700-bed tertiary care teaching center. The University Hospital of Basel is one of Switzerland's five university medical centers, consisting of 52 departments and institutes with interdisciplinarity as a strategic aim. It serves a population of 500,000, and more than 45,000 trauma and non-trauma patients are seen in the ED every year. Specialists of all disciplines and subspecialties are available around the clock. The local ethics committee (Ethikkommission Nordwest- und Zentralschweiz) approved the study protocol. Recruitment took place during three staff meetings in the departments of cardiology, internal medicine, and emergency medicine. Physicians gave their written informed consent.

Physicians were fully informed about the study's goal: To determine the ideal quantity and content of effective discharge communication with chest pain patients. Specifically, physicians were presented with a list of 81 items that could potentially be addressed at discharge. This initial list was constructed by three physicians with over 10 years of

experience, taking advantage of their first-hand knowledge of discharge communication. Participating physicians first read an original case vignette (see below) of a common clinical problem (i.e., a patient presenting with chest pain). They then selected the items they felt needed to be addressed in a (typical) discharge interaction of less than 15 minutes (items were not ranked). The standardized instruction read as follows: "You are the responsible physician and plan a discharge interaction lasting less than 15 minutes with the patient described above. From your point of view, which of the points listed below should be discussed?"

2.1.2.1. Case vignette. A 63 year old male patient, accompanied by his wife, presented to the ED because of left-sided chest pain. At presentation he was free of symptoms. Chest pain was associated with exertion (walking uphill, climbing stairs) and subdued when resting. He noted progressive exercise intolerance for the past four weeks. Neither dyspnea nor orthopnea were reported. His past medical history consisted of hypertension, diagnosed five years ago, and an ongoing smoking history of 20 pack-years. His father died after a stroke at age 78, and his mother suffered from hypertension and diabetes mellitus II for several years. His present medication consisted of a calcium channel blocker. Even though myocardial infarction was excluded by repeated high-sensitive troponin and electrocardiogram, further work-up was warranted because of typical angina symptoms and a high degree of likelihood of coronary heart disease.

For further work-up a myocardial scintigraphy was planned the following week (date and time known), the recommended therapy consisted of aspirin and beta-blockers; nitroglycerin was given in case of chest pain, and a visit with his family physician was to be scheduled in the meantime.

Independently, seven experts were asked to estimate the time needed for communicating each item featured on the questionnaire. Experts were instructed to only

consider the time spent communicating the information and omitting the time consumed by responding to a patient's questions (examples given in Table 1). Estimated times for all items were averaged across the seven experts' ratings. Then we combined the experts' time estimates with each physician's personal selection of crucial items. Specifically, we multiplied, separately for each physician, each selected item with the experts' mean time estimates for this item. Across a physician's chosen set of crucial items, we thus estimated the total time required to actually communicate these items.

Table 1

Examples of Items and the Time for Information-Giving as Estimated by Experts

Item	Estimated time
State the presumptive diagnosis	1 minute
Address risk factors	
State why further investigation is necessary	2 minutes
Explain alternatives to the proposed investigation	
Explain the significance of the presumptive diagnosis	3 minutes
Explain the association of symptoms with the suspected diagnosis	
Explain the pathophysiology of coronary heart disease	4 minutes
Inform about the consequences in case of a positive stress test	

2.1.3. Participants. All 47 physicians present during meetings volunteered to participate. For each physician, the following information was recorded: age, sex, position, specialty, experience in the specialty (in years), and overall clinical experience (in years).

2.1.4. Statistical Analysis. Collected data was analyzed with SPSS (version 17.0). Mean and range of required time estimates and number of items chosen were assessed for each group. An independent-samples t-test was conducted to assess differences between groups.

2.2. Results

2.2.1. Participants. Among the 47 participating physicians (19 women), there were six interns, 11 residents, 25 consultants, four senior consultants, and one department head. The average clinical experience was 10.1 years (SD = 8.29). Among these, nine were currently working as emergency physicians, with a mean (SD) clinical experience of 12.2 (6.5) years. The remaining 38 physicians were working in internal medicine and cardiology (henceforth called "internists"), with a mean (SD) clinical experience of 9.62 (8.72) years. The experts' mean (SD) clinical experience in the field was 18.1 (7.68) years.

2.2.2. Main Results. Out of the 81 items provided, an overall mean (SD) of 36.3 (9.82) was chosen (45%), with a range of 20 to 57 items. Mean (SD) estimate of the time required to communicate these items was 44.5 (12.8) minutes (range 25-74 minutes). As shown in Table 2, the mean (SD) number of items chosen by internists was 37.4 (10.2), and 31.6 (6.19) chosen by emergency physicians, respectively. The difference between the two groups proved to be not statistically significant ($t_{(45)} = 1.64$, $p = 0.11$, d = 0.41). The distribution of the number of items, chosen by internists and by emergency physicians, respectively, is shown in Figure 1.

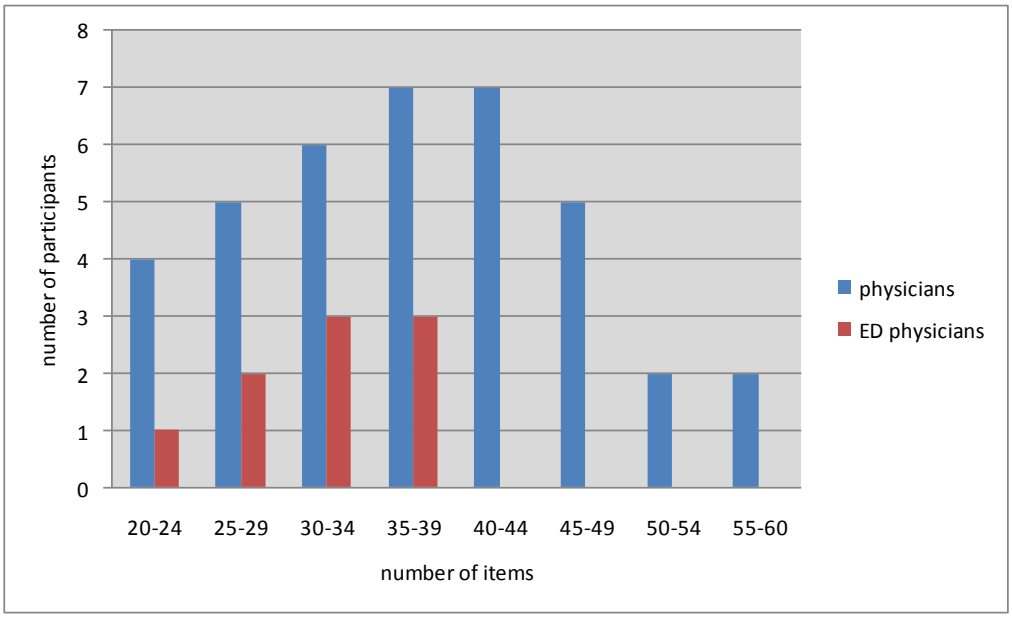

Figure 1. Number of items, chosen by physicians and by ED-physicians pespectivly.

The mean (SD) time derived for communicating the discharge information, selected by the physicians, amounted to 46.4 (13.5) and 36.9 (6.34) minutes for internists and emergency physicians, respectively (Table 2). This is 3.1 and 2.7 times longer than the preset time window for the task of discharge communication. This difference between groups proved to be significant (t (45) = 2.04, p = 0.047, d = 0.73).

Table 2

Results of Preliminary Study

Specialty (n)		Mean	SD
Internists (38)	No of items chosen	37.4	10.2
	Time needed (min)	46.4*	13.5
Emergency Physicians (9)	No of items chosen	31.6	6.19
	Time needed (min)	36.9*	6.34

Note: * indicate statistically significant differences between the two groups tested.

3. Study 1

Outline

This is a modified part (methods and results) of a manuscript accepted in October 2014 in the Journal "Health Communication" (see annex) with the title

Discharge Communication in Patients Presenting to the Emergency Department with Chest Pain: Defining the Ideal Content

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3.1. Methods

3.1.1. Study Design. The single-center cross-sectional study 1 comprised two phases: First, we quantitatively analyzed physicians' views of the ideal content of an ED discharge communication for patients presenting with acute chest pain. Second, we assessed affected patients' evaluations of this content, both quantitatively and qualitatively. Study 1 thus implemented a mixed methods approach incorporating elements derived from both quantitative and qualitative traditions: (1) A comprehensive list of items that could potentially be discussed at discharge were evaluated by both patients and physicians in paper-and-pencil format. (2) Face-to-face interviews (free generation task) were conducted with ED patients presenting with chest pain, and the transcripts were subjected to qualitative analysis. The mixed methods approach has proved valuable in various healthcare communication studies (Arora et al., 2010; Bennett, Switzer, Aguirre, Evans, & Barg, 2006; Cherlin et al., 2005; van Staa & Group, 2011; Wittink, Barg, & Gallo, 2006). Mixed methods research has the potential to collect, analyze, and combine both quantitative and qualitative data in a single study. We used a mixed methods design as it accommodates key aims of this study: (1) To determine, through quantitative methods, the ideal content of ED discharge communication with chest pain patients from both the senders' and the receivers' perspective, and to formalize a comparison between these, and (2) to elicit, through qualitative methods, patients' perspectives on the information required at discharge. Physicians (cardiologists, internists, and ED physicians; $N = 47$) and chest pain patients awaiting ED discharge ($N = 51$) were the main sources of information.

3.1.2. Setting. For study 1, we analyzed the data obtained from physicians through the preliminary study with regards to content. Patients' data collection was conducted at the ED of the University Hospital of Basel. The local ethics committee (Ethikkommission Nordwest-

und Zentralschweiz) approved the study protocol. Patients and physicians gave written informed consent.

3.1.3. Phase One: Physicians.

3.1.3.1. Participants. See preliminary study (Setting and Procedures).

3.1.3.2. Procedures and Data Collection. See preliminary study (Setting and Procedures).

3.1.4. Phase Two: Patients.

3.1.4.1. Participants. Recruitment took place from May 2012 to October 2012 in the ED of the University Hospital of Basel on weekdays during the day shift. The electronic patient tracking system was screened to identify those patients with chest pain who had completed clinical work-up and were awaiting discharge from the ED. Exclusion criteria were chosen to limit participation to patients with an intermediate risk of coronary heart disease (CHD). Specifically, patients meeting one or more of the following conditions were excluded:

- High-risk features in an ECG (electrocardiogram) (e.g., ST elevation) and/or increased high-sensitive troponin levels (to exclude high-risk patients),
- none of the following cardiovascular risk factors: smoking history, diabetes, hypertension, dyslipidemia, age above 50 years, family history of CHD (to exclude low-risk patients),
- dementia, as defined by a score of < 7 on a clock-drawing test,
- age under 18 years,
- limited German language skills (German being the default language at the hospital).

3.1.4.2. Procedures and Data Collection. Study enrollment was conducted shortly before the discharge communication. Chest pain patients were presented with a text informing them about the study's goal and procedure: to determine the ideal content of effective

discharge communication with chest pain patients. After giving their written informed consent, patients responded to demographic questions (age, sex, profession, race, and nationality). Their emergency severity index (ESI) was recorded (Gilboy, Tanabe, & Travers, 2005). Face-to-face interviews (free generation task), in which patients were asked for their thoughts on the information to be provided at discharge, were conducted first. Specifically, patients were asked the following open-ended question: "With respect to the upcoming discharge interaction with your attending physician: What kind of information is important to you?" If patients' statements were irrelevant, we tried to guide them by briefly repeating the question.

Subsequently, the patients were presented with a list of the 34 items endorsed by the majority of study physicians (see Results section). Some items were rephrased in lay terms to make them comprehensible (based on the results of a pre-study with 30 ED patients who evaluated the comprehensibility of each item; items not understood by more than 20% of patients were rephrased until comprehensible). For each item, patients stated whether they would prefer it to be included in or excluded from a discharge interaction, whether they had no preference, or whether they found the item incomprehensible. We collapsed the categories "excluded" and "no preference," treating both as "undesired." Only 39 of the 1734 responses evaluated an item to be "incomprehensible," and they were reasonably evenly spread across all 34 items. We therefore treated these responses as "missing," and did not have to exclude any items (only the items concerning beta blockers and nitroglycerine were incomprehensible to a greater amount of patients (i.e. 10 and nine patients, respectively), but as most patients who understood them considered them crucial, they were also not excluded). All responses were rendered anonymously.

3.1.5. Consensus Classification System. Having used physicians' and patients' answers to define the ideal content of an effective discharge communication (34 items), we

sought to group these items into the smallest possible number of discrete informational categories. To this end, we identified three expert physicians with more than 12 years of experience in the field and a position that involved student teaching and training of junior physicians. These experts discussed the items and potential categories, and reviewed the results in several rounds until five categories emerged (see below for results).

3.1.6. Data Analysis. Descriptive statistics (means, standard deviations) and analyses were calculated with SPSS for Windows (v. 18). Patients' answers to the free generation task were audiotaped, transcribed verbatim, and coded. After the three experts had achieved consensus on the five categories of information, two independent raters coded each transcript by mapping patients' answers to the categories of the consensus classification system (see below). In case of disagreement, consensus was reached through joint analysis and discussion of the audiotapes and the transcripts. An inter-rater reliability analysis using Kappa statistics was performed to determine consistency among raters (Landis & Koch, 1977). The ten most frequently named patients' informational needs that could not be assigned to the classification system were then noted. Because this method is not empirically derived, it is only a best approximation for evaluating the audiotaped responses. Correlations between the percentages of physicians and patients who endorsed the respective items were calculated using Pearson's correlation coefficient. Concordance between the two distributions of the items was calculated using Mann–Whitney U test.

3.2. Results

3.2.1. Participant Characteristics.

3.2.1.1. Physicians. See preliminary study (Participant Characteristics)

32.1.2. Patients. A total of 187 patients were consecutively screened for inclusion. Of those, four were excluded because of dementia; two because they were aged under 18; 67 because of increased troponin levels or high risk features in the ECG; seven because of lack of cardiovascular risk factors; and 33 because of limited language skills. Finally, 23 patients were excluded for miscellaneous other reasons (mostly no informed consent). A final sample of 51 patients resulted.

The mean (SD) age of the 51 patients (22 women) was 53.8 (16.7) years, with a range of 21 to 83 years. All patients presented to the ED because of chest pain, and data were obtained in the ED (41 patients) or the ED-associated monitoring and decision unit (10 patients). A total of 35 (69%) patients had an ESI level of two; 16 (31%) had an ESI level of three. The majority (63%) were Swiss; the rest had various other nationalities (Portuguese, Spanish, German, Sri Lankan, Turkish, Italian, and Serbian), a mix typical for Swiss urban EDs.

3.2.2. Consensus between Patients and Physicians. Physicians were first presented with the full list of 81 items. The 34 items with > 50% physician endorsement (as opposed to the preliminary study, where we considered the mean number of items that physicians selected) were then presented to the patients. Table 3 lists these 34 items and the proportions of physicians and patients endorsing them. All but two of the 34 items endorsed by the majority of physicians were also judged to be important by more than 50% of patients (i.e., 32 of the 34 items); 26 were endorsed by more than 75% of patients. One item was endorsed by

less than 50% of all patients ("address the need to stop smoking"; however, this item was selected by 59% of patients with present or past smoking history). Finally, one item was endorsed by exactly 50% of patients ("Encourage the patient to make an appointment with his family physician to obtain more information"), but by about two-thirds of physicians.

Table 3

Endorsement of the 34 Items, Classified to the Five Categories, by Physicians and Patients, Respectively

Category	Item	Physicians (N = 47)	Patients (N = 51)
Information on diagnosis (7 items)	Inform the patient that he is ready to go home	89%	96% (48/50)
	Reassure the patient ("you were right to come to the ED")	72%	73% (37/51)
	Explaining that blood, heart, and lungs were thoroughly examined	57%	100% (51/51)
	State the presumptive diagnosis	83%	98% (49/50)
	Broad statement: "All the investigations exclude a diagnosis of myocardial infarction at this time"	79%	94% (48/51)
	Explain the significance of the presumptive diagnosis	66%	96% (48/50)
	Explain the association of symptoms with the suspected diagnosis	62%	96% (49/51)
Follow-up suggestions (9 items)	State why further investigation is necessary	94%	92% (47/51)
	State what the planned investigations are	89%	75% (38/51)
	State when the investigations will be carried out	77%	88% (45/51)
	State where the investigations will be done	74%	82% (42/51)
	Describe necessary precautions for the test (no coffee, no tea, …)	64%	88% (45/51)
	Explain that an information sheet with details of the pretest preparation will be sent by post	57%	65% (33/51)
	Explain that detailed information on the time and location of the test will be sent by post	68%	78% (39/50)
	Advise the patient to contact his family physician should he have further questions	79%	65% (33/51)
	Encourage the patient to make an appointment with his family physician to obtain more information	68%	50% (25/50)

Advice on self-care (4 items)	Address risk factors	53%	94% (48/51)
	Address the need to stop smoking	83%	48% (24/50)
	Address current avoidance of physical stress	81%	78% (39/50)
	Recommend that the patient resumes normal daily activities	53%	90% (46/51)
Red flags (6 items)	Stress that the patient should present immediately to the ED in case of chest pain radiating into arms/jaws	83%	94% (48/51)
	Stress that the patient should present immediately to the ED if the symptoms last longer than 10 minutes	81%	86% (44/51)
	Stress that the patient should present immediately to the ED if he is dyspnoeic	68%	92% (46/50)
	Stress that the patient should present immediately to the ED if he experiences chest pain not responding to nitroglycerine	96%	88% (43/49)
	Explain that the ED is open 24/7 (“you may come back any time”)	68%	63% (32/51)
	Reassert the importance of presenting immediately to the ED in case of any complaints or symptoms, even at night	57%	53% (27/51)
Complete treatment (all medication) (8 items)	Explain that treatment has to start immediately	55%	90% (46/51)
	Explain why treatment has to start immediately	70%	86% (44/51)
	State the names of the new medications (ASS, beta blocker, nitroglycerine spray)	96%	76% (39/51)
	Give the ASS dose and explain when it should be taken	66%	84% (42/50)
	Give the beta blocker dose and explain when it should be taken	64%	88% (36/41)
	Describe the side effects of beta blockers	53%	85% (39/46)
	Give the nitroglycerine dose and explain when it should be taken	81%	86% (36/42)
	Describe the side effects of nitroglycerine	62%	89% (42/47)

Note. Percentages indicate the proportion of physicians and patients, respectively, who selected each item. In brackets: Number of patients selecting the item/number of patients comprehending the item.

3.2.3. Application of the Consensus Classification System. Given the high concordance between physician and patient perspectives, we used the condensed list of 34 items to generate categories. Working individually, three expert physicians identified a small number of non-overlapping basic categories to which the individual items could be assigned and classified each item to those categories. Each individual classification system was then shared and discussed with the others, with the goal of arriving at a system agreed upon by all participants. The resulting classification system comprises five categories (Table 3): Seven items were assigned to the category "Information on diagnosis," nine to the category "Follow-up suggestions," four to the category "Advice on self-care," six to the category "Red flags," and eight to the category "Complete treatment."

The correlation between the percentage of items endorsed by patients and that endorsed by physicians proved to be essentially nil ($r = 0.013$; $p = 0.94$). Yet concordance between patients and physicians was high, with 32 of the 34 items selected by the majority of physicians also being selected by the majority of patients. A Mann–Whitney U test demonstrated that the two distributions did not differ significantly from each other ($U = 544$, $p = 0.15$).

3.2.4. Patients' Needs as Elicited by the Free Generation Task. Two independent raters also used the consensus classification to categorize patients' freely generated answers; inter-rater reliability was fairly high (Kappa = 0.70 [$p < 0.01$], 95% CI [0.61–0.79]). All disagreements between the two independent raters could be resolved by discussion, consulting the other authors as experts. Patients' responses in the free generation task showed greater variation across the categories of the consensus classification system. A total of 84% of patients voiced a need to receive information on their diagnosis, 22% on their follow-up, 55% on self-care, 20% on red flags, and 14% on their complete treatment. Numerous statements could not be assigned to the categories of the classification system. Table 4 lists patients' 10

most frequently named needs as derived from the free generation task. All of these items concerned the style or form, but not the content, of the discharge communication. As the focus of this study was on defining the ideal content of discharge communication, they were not appended to the condensed list of items.

Table 4

The 10 Most Frequently Named Patient Needs as Elicited by the Free Generation Task

Patients wish…
to feel cared for
to be reassured
to be taken seriously
to have the opportunity to ask questions
to have their questions answered
to be able to spend sufficient time with the physician
for the physician to do their best
for the physician to use appropriate language
for the physician to admit if they do not know something
for the physician to be completely honest without concealing details

3.2.5. Generation of a Mnemonic Acronym. Using the initial letter(s) from the classification categories, we generated the acronym “InFARcT” (In: **In**formation on diagnosis; F: **F**ollow-up suggestions; A: **A**dvice on self-care; R: **R**ed flags; cT: **c**omplete **T**reatment). This acronym is not a neologism but represents a word with an established meaning both in the medical nomenclature and (in German-speaking countries) in everyday discourse. It is obviously also highly pertinent to patients with acute chest pain.

4. Study 2

Outline

This is a modified part (methods and results) of a manuscript accepted in February 2015 in the Journal "Patient Education and Counselling" (see annex) with the title

Improving Patient Recall of Information: Harnessing the Power of Structure

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4.1. Methods

4.1.1. Study Design. Study 2 was a prospective cross-sectional trial at the University of Basel, Switzerland. The study was approved by the local ethics committee (Ethikkommission Nordwest- und Zentralschweiz). Participants received partial credit for their participation.

4.1.2. Setting and Participants. The study was conducted during regular weekly lectures in two auditoriums of the University of Basel. *First year psychology* students were invited to participate in a trial measuring recall of medical information. Overall, 98 students agreed to participate and provided written informed consent.

4.1.3. Randomization and Interventions. On their arrival, *first year psychology students* were randomly allocated to one of the auditoriums. They were given written information that they were participating in an experiment about physicians' communication style, and that they would be shown a video of a physician discharging a patient from the ED (Figure 3, study 3). The patient was a white man of around 75 years of age, played by an actor. The elements included consisted of 28 of the 34 items endorsed by patients and physicians in study 1 (Ackermann et al., in press); the remaining six items were omitted (after careful discussion among three expert physicians (with more than 12 years of experience in emergency medicine and psychosomatic medicine, respectively; co-authors)) in order to reduce the list from 34 to 28 items.

The two student groups watched the same male physician (Wolf Langewitz) deliver exactly the same 28 items of information in a friendly manner and without the use of medical jargon in either structured or non-structured form. Specifically, in the non-structured condition (group NS), the order of presentation was based on traditional clinical wisdom: pieces of information that belonged together because they pertained to, for example, the likely

diagnosis of coronary artery disease were presented in one block of information (likewise, there were blocks of information on pathophysiology, further work-up, therapy, and red flags). However, there was no *explicit* structure. In the structured condition (group S) the information presented was structured following the structural elements of a book, in which the content is presented in a specific order, typically advancing from summary, high-level information (e.g., title, table of contents, chapter headings) to detailed, low-level information (e.g., text, annexes). Study authors reviewed the two versions of the video to make sure that both contained the same factual information. Following the book structure (Langewitz, 2012), the physician initiated the interaction as follows:

4.1.3.1. Initiation of Interaction. Mr. Lehmann, I will now give you some *discharge information* (TITLE).

Before you go home, there are five points that I would like to inform you about (TABLE OF CONTENTS)

First: What is your diagnosis?

Second: What will happen next?

Third: What can you do yourself?

Fourth: What do you have to pay attention to in order to be on the safe side?

Finally, the fifth and last point: What will the treatment look like?

Let me start with the first point: What is your diagnosis (1st CHAPTER HEADING):

The good news is that you don't have a myocardial infarction ….. (TEXT).

4.1.4. Outcome Measures. Immediately after watching the video (and without prior warning), students were given five minutes to write down all the information they remembered from the exchange. They were asked not to consult their neighbors. No further instructions were given. Students were then asked to complete a questionnaire assessing their prior medical knowledge. This multiple-choice questionnaire covered the following topics: definition of myocardial infarction; definition of angina pectoris; risk factors for cardiovascular disease; typical pain sensations in myocardial infarction; cardiac angiography; physiological processes typically associated with cardiac pain (see table 5, study 3). They then rated their current mood (visual analogue scale (VAS) from 0 [*very bad*] to 10 [*very good*]), their level of attention on the day of the study (VAS from 0 [*very low*] to 10 [*very high*]), and their perception of the physician on three items (the comprehensibility of the physician, the structure of the dialogue, and their willingness to recommend the physician to friends and relatives; VAS from 0 [*very low*] to 10 [*very high*]). Additionally, the following variables were recorded: gender, age, nationality, number of semesters completed, faculty, and university. In order to maintain anonymity, we asked participants to mark their questionnaires with a personalized code.

Students' recall performance (i.e., the number of items of information recalled) was assessed by two independent raters, one of whom rated all of the protocols and the other, 10% of them. Analyses of the agreement between the two raters resulted in a Cohen's kappa of 0.74, indicating substantial interrater reliability according to Landis and Koch (1977). When it became clear that some students in the structured condition had also noted down chapter headings, we also assessed the extent to which students recalled these structuring elements. Both raters independently screened all protocols to identify the five chapter headings listed in the example above. They agreed fully on the number of protocols in which at least one

chapter heading was recalled and differed in the number of chapter headings recalled in only two of those 33 cases. Agreement was achieved by discussing these differences.

4.1.5. Statistical Analysis. All data were analyzed with SPSS (v. 18). Items recall is presented in terms of the percentage of students who noted down each item in the recall protocol. We report means and standard deviations for students' current mood, attention level, and perceptions of the physician in the two conditions; comparisons between groups were conducted using *t*-tests for independent samples. The influence of prior medical knowledge, current mood, and level of attention on recall was assessed by an analysis of covariance (ANCOVA), with number of recalled items as the dependent variable and condition as the independent variable.

4.2. Results

4.2.1. Participants. Demographics of the *first year psychology students* are summarized in Table 6 of study 3.

4.2.2. Primary Finding. The mean (SD) number of items recalled was 8.12 (4.31) in the structured condition ($N = 57$) and 5.71 (3.73) in the non-structured condition ($N = 41$; $p = 0.004$). The mean (SD) for the whole sample was 7.11 (4.23) items (Table 6 of study 3).

4.2.3. Secondary Finding. No differences between group S and group NS were observed in the VAS ratings of current mood on the day of the study (M=6.51, SD=1.78 in both groups; n.s.; Table 8 of study 3). Students in group S reported higher levels of attention (M=6.50, SD= 1.81 vs. M= 5.58, SD=2.01; p=0.03; Table 8 of study 3). Students in the structured group answered mean (SD) 3.20 (1.29) items correctly in the prior medical knowledge assessment, slightly but not significantly more than their counterparts in the non-structured group (M=2.94, SD=1.08; n.s.). Both groups' perceptions of the physician,

showing more positive responses in the structured group, are summarized in Table 6 and 7 of study 3).

Of the 57 participants in the structured condition, 33 spontaneously listed mean (SD) 3.45 (1.23) chapter headings in addition to factual items. Students who did not list chapter headings recalled mean (SD) 8.33 (4.40) items; those who did recalled mean (SD) 7.97 (4.27) items (n.s.). None of the covariates (prior medical knowledge, age, gender, current mood, level of attention, perception of the physician) influenced the number of items recalled. More detailed results are provided in the results-section of study 3.

5. Study 3

Outline

This is a modified part (methods and results) of a manuscript submitted in February 2015 to the Journal "PLOSone" (see annex) with the title

Information Structuring Improves Recall of Emergency Discharge Information

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5.1. Methods

5.1.1. Design Overview. We conducted a prospective cross-sectional multicenter trial at the Universities of Basel, Switzerland, and Mannheim, Germany, using a 3x2 between-subjects experimental design, the factors being "condition" (structured vs. non-structured) and "group" (*first year psychology students vs. first year medical students vs. third year medical students*) and the dependent variable being number of items recalled. The study protocol was approved by the local ethics committee (Ethikkommission Nordwest- und Zentralschweiz). Written informed consent was obtained from all participants.

5.1.2. Setting and Participants. Study 3 was conducted during regular weekly lectures in two auditoriums at the Universities of Basel and Mannheim. The data obtained from *first year psychology students* in study 2 (Wolf Langewitz et al., in press) was also analyzed in study 3. Besides that, we recruited two independent populations: *first year medical students* at the University of Mannheim (n = 97), and *third year medical students* at the University of Basel (n = 39). Using students as proxy patients, we investigated whether structuring discharge information had any benefit for recall and possible correlations with the level of medical knowledge.

5.1.3. Randomization and Interventions. The study flow is shown in Figure 2. Students of all three groups were randomly assigned to either the structured (S) or the non-structured (NS) condition at the outset of the lecture and were then independently shown either the structured or the non-structured video that we used in study 2 (Figure 3).

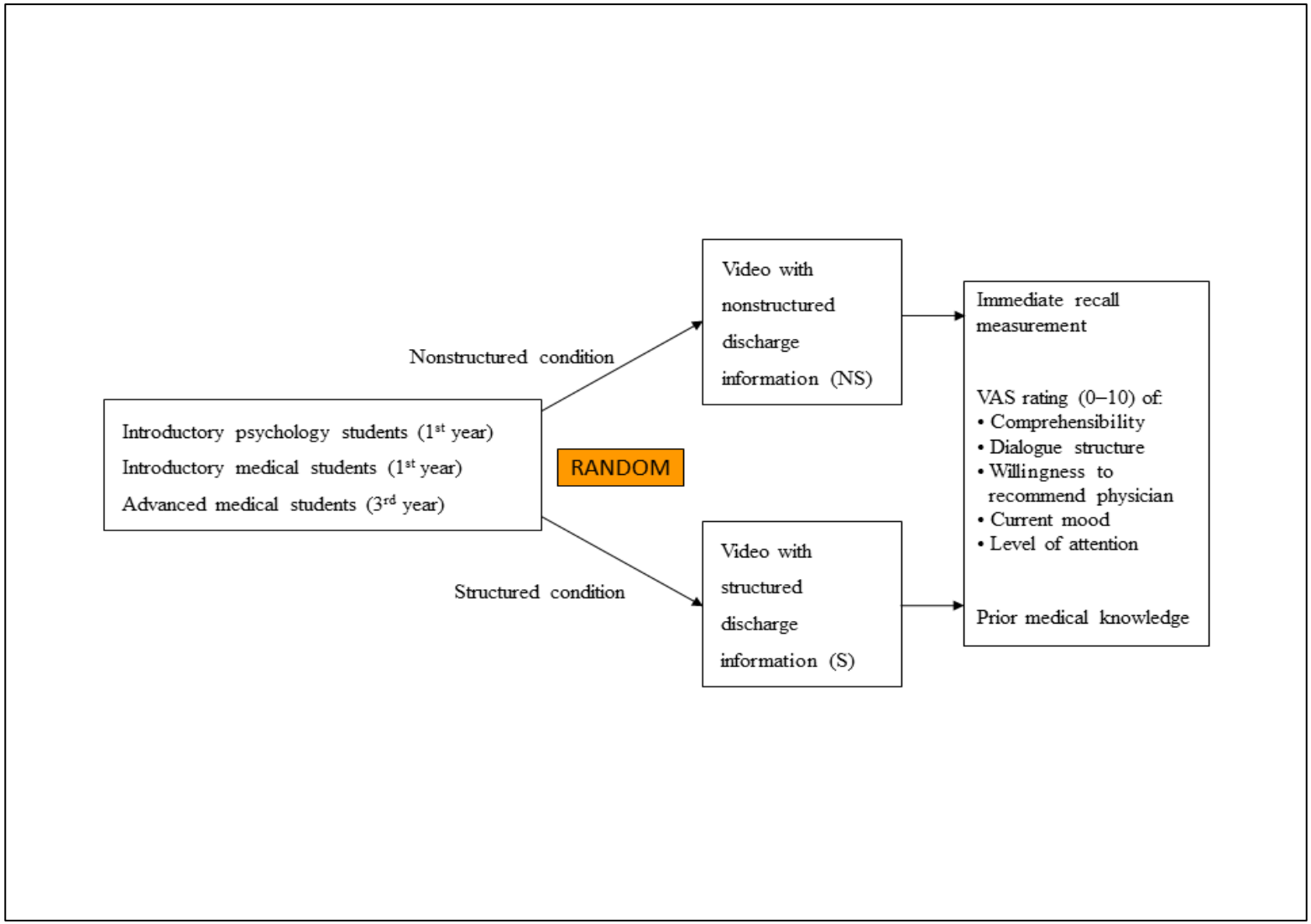

Figure 2. Study flow (study 3)

Figure 3. Screenshots from the discharge communication videos shown to participants. Participants were asked to imagine being in the patient's position while viewing either a structured or an non-structured communication event and were not informed of the upcoming memory test

Identical to the *first year psychology students* in study 2, participants of the other two groups were also given five minutes to take down all the items of information they remembered after watching the videos (immediate recall) and were subsequently instructed to work on the same additional material that was used in study 2 (i.e., VAS-assessment of level of attention, current mood, and the perception of the physician). Their medical knowledge was again tested by the same multiple choice test comprising six questions (Table 5).

Table 5

Multiple Choice Questions Used to Assess Participants' Prior Medical Knowledge (Correct Answers in Bold)

	Question	**Answers**
Q1	A myocardial infarction is	A: a sudden irregularity of the cardiac pulse/rhythm leading to severe pain B: a gradual narrowing of the heart's coronary vessels C: a sudden weakness of the cardiac muscle **D: death of part of the cardiac muscle due to lack of oxygen**
Q2	Angina pectoris is defined as	A: dyspnea caused by disturbed heart rhythm B: pain caused by an overstrained heart **C: pain caused by short-term underoxygenation of the cardiac muscle** D: disturbed heart rhythm caused by short-term of the cardiac muscle

Q3	What is a risk factor for cardiovascular diseases?	A: heavy work (physical labor, intensive sports) **B: diabetes mellitus** C: frequent viral infections D: electromagnetic radiation (e.g., from a cell phone)
Q4	Typical pain sensations in myocardial infarction	A: increase during inhalation **B: radiate into the left arm** C: occur with sudden limb movement D: radiate from the left thorax to the right thorax
Q5	A cardiac angiography is	A: an ultrasound of the coronary vessels B: a computed tomography (CT) of the coronary vessels C: an ultrasound of the heart **D: a radiographic examination of the coronary vessels**
Q6	Typical cardiac pain worsens with	A: rapid breathing B: emotional stress **C: physical exertion** D: lifting of both arms

5.1.4. Outcome Measures. As was the case in study 2, the key memory measure of interest was immediate recall performance expressed as the number of items recalled. As opposed to study 2, we did not assess the extent to which students recalled chapter headings.

5.1.5. Statistical Analyses. All analyses were performed with SPSS for Windows (v. 18). The difference in recall performance between each pair of the three groups (main effect of "group": *first year psychology students* vs. *first year medical students*; *first year psychology students* vs. *third year medical students*; *first year medical students* vs. *third year medical students*) and between the two conditions (main effect of "condition": structured vs. non-structured discharge information) as well as their interaction "group x condition" was assessed by the means of a 2x3 analysis of variance (ANOVA). Non-parametric Mann-Whitney tests were performed to probe for inter- and intragroup differences in medical knowledge of *first year psychology students, first year medical students*, and *third year medical students*. A t-test analysis was used to compare differences between the structured and non-structured conditions in terms of participants' VAS ratings of the comprehensibility of the physician, the structure of the dialogue, willingness to recommend the physician to friends and relatives, current mood, and level of attention. Finally, in order to establish the independence of the main effects "group" and "condition" as well as their interaction "group x condition" from the influence of current mood, and level of attention on the number of recalled items, we performed a 2x3 analysis of covariance (ANCOVA), again number of recalled items being the dependent variable and "group" (*first year psychology students* vs. *first year medical students*; *first year psychology students* vs. *third year medical students*; *first year medical students* vs. *third year medical* students) and "condition" (structured vs. non-structured) being the factors. All tests were performed at a significance level of $\alpha = 0.05$.

5.2. Results

5.2.1. Recall. Demographics of the study sample are summarized in Table 6. The ANOVA revealed a significant main effect of "condition", $F(1, 228) = 4.45$; $p = 0.036$; $\eta p2 = 0.019$, albeit with a small effect size, $d = 0.28$ ($d = 0.2$, 0.5, and 0.8 represent effects of small, medium, and large size, respectively; (Cohen, 1988)). Overall, the 234 participating students

recalled a mean of 9.12 of the 28 items (33%) presented (range: 0-23 items). Students randomized to the structured condition recalled a mean of 9.70 items (35%); those randomized to the non-structured condition recalled a mean of 8.31 items (30%). The main effect of "group" on recall performance proofed also to be significant, $F(1, 228) = 27.9$; $p < 0.01$; $\eta_p^2 = 0.196$. The *third year medical students* recalled the highest number of items ($M = 13.2$, 47%, range: 4-23), followed by the *first year medical students* ($M = 9.47$, 34%, range: 0-19), and the *first year psychology students* ($M = 7.11$, 25%; range: 0-19). Each comparison between pairs of groups was statistically significant (*first year psychology students* vs. *first year medical students*: $p < 0.01$; $d = 0.52$; *first year psychology students* vs. *third year medical students*: $p < 0.01$; $d = 1.43$; *first year medical students* vs. *third year medical students*: $p < 0.01$; $d = 0.80$).

Table 6

Participants' Demographic Characteristics, Prior Medical Knowledge, VAS Ratings and Primary Findings

Characteristic	**Overall**			***First year medical students***			***First year psychology students***			***Third year medical students***		
	Overall	**S**	**NS**	**Overall**	**S**	**NS**	**Overall**	**S**	**NS**	**Overall**	**S**	**NS**
	(*n* = 234)	**(*n* =136)**	**(*n* = 98)**	**(*n* = 97)**	**(*n* = 59)**	**(*n* = 38)**	**(*n* = 98)**	**(*n* = 57)**	**(*n* = 41)**	**(*n* = 39)**	**(*n* = 20)**	**(*n* = 19)**
Demographics												
Male sex, n(%)	70(30)	40(29)	30(31)	43(44)	26(44)	17(45)	16(16)	10(17)	6(15)	11(28)	4(20)	7(37)
German mother tongue, n(%)	216(92)	122(90)	93(95)	93(96)	55(93)	37(97)	85(87)	57(100)	37(90)	38(97)	20(100)	19(100)
Age (y), *M*(*SD*)	22(3.6)	22(3.1)	22(4.1)	21(3.3)	21(3.1)	22(3.6)	22(3.8)	22(3.5)	22(4.3)	23(3.3)	22(0.9)	24(4.5)
Prior medical knowledge												
Correct answer Q1, *n*(%)	156(67)	91(67)	65(66)	92(95)	55(93)	37(97)	27(28)	17(30)	10(24)	37(95)	19(95)	18(95)
Correct answer Q2, *n*(%)	190(81)	106(78)	84(86)	85(88)	50(85)	35(92)	67(68)	37(65)	30(73)	38(97)	19(95)	19(100)
Correct answer Q3, *n*(%)	164(70)	90(66)	74(75)	84(87)	50(85)	34(89)	41(42)	20(35)	21(51)	39(100)	20(100)	19(100)
Correct answer Q4, *n*(%)	200(85)	120(88)	80(82)	94(97)	59(100)	35(92)	68(69)	41(72)	27(65)	38(97)	20(100)	18(95)
Correct answer Q5, *n*(%)	124(53)	70(51)	54(55)	66(68)	39(66)	27(71)	27(28)	16(28)	11(26)	31(79)	15(75)	16(84)
Correct answer Q6, *n*(%)	193(82)	115(85)	78(80)	87(90)	51(86)	36(95)	68(69)	45(79)	23(56)	38(97)	19(95)	19(100)
VAS ratings (0-10)												
Comprehensibility, *M*(*SD*)	7.0(2.4)	7.9(2.0)	5.7(2.3)	7.3(2.3)	8.2(1.8)	5.9(2.3)	7.2(2.2)	8.0(1.9)	6.1(2.2)	5.6(2.6)	6.8(2.3)	4.2(2.1)
Dialogue structure, *M*(*SD*)	7.0(2.7)	8.4(1.7)	5.0(2.6)	7.2(2.7)	8.6(1.8)	5.0(2.4)	7.2(2.6)	8.5(1.5)	5.5(2.7)	6.2(2.8)	8.0(1.7)	4.3(2.4)
Willingness to recommend, *M*(*SD*)	6.2(2.7)	7.1(2.4)	4.9(2.6)	6.2(2.7)	7.2(2.3)	4.8(2.5)	6.5(2.7)	7.1(2.7)	5.8(2.6)	5.0(2.7)	6.7(2.2)	3.4(2.3)
Current mood, *M*(*SD*)	6.2(1.7)	6.2(1.8)	6.4(1.7)	6.0(1.7)	6.0(1.7)	6.1(1.9)	6.5(1.8)	6.5(1.8)	6.5(1.8)	6.2(1.6)	5.9(1.7)	6.4(1.5)
Level of attention, *M*(*SD*)	6.0(7.8)	6.2(1.7)	5.7(1.9)	5.7(1.7)	5.8(1.6)	5.6(1.8)	6.1(1.9)	6.5(1.7)	5.6(2.0)	6.1(1.7)	6.3(1.4)	5.9(2.0)

Primary findings												
Number of items recalled, *M*	9.12	9.70	8.31	9.49	9.95	8.76	7.11	8.12	5.71	13.23	13.45	13.00
Range	0-23	0-23	0-19	0-19	0-19	0-18	0-19	0-19	0-18	4-23	5-23	4-19
Standard deviation	4.98	4.96	4.93	4.84	5.03	4.49	4.84	4.31	3.73	4.43	4.48	4.49

Next, we considered the potential benefit of structure as a function of medical knowledge (Figure 4). Although the interaction of "condition x group" proved to be statistically non-significant ($F(2, 228) = 0.80$; $p = 0.45$; $\eta_p^2 = 0.007$), the magnitude of the effects of information structuring seems to vary systematically by the degree of medical knowledge: although only a negligible difference of structured information could be observed in *third year medical students* ($M_S = 13.5$ vs. $M_{NS} = 13.0$; $d = 0.12$), we found a small effect size of information structuring in *first year medical students* ($M_S = 9.95$ vs. $M_{NS} = 8.76$; $d = 0.24$), and a medium effect size in *first year psychology students* ($M_S = 8.12$ vs. $M_{NS} = 5.71$; $d = 0.60$).

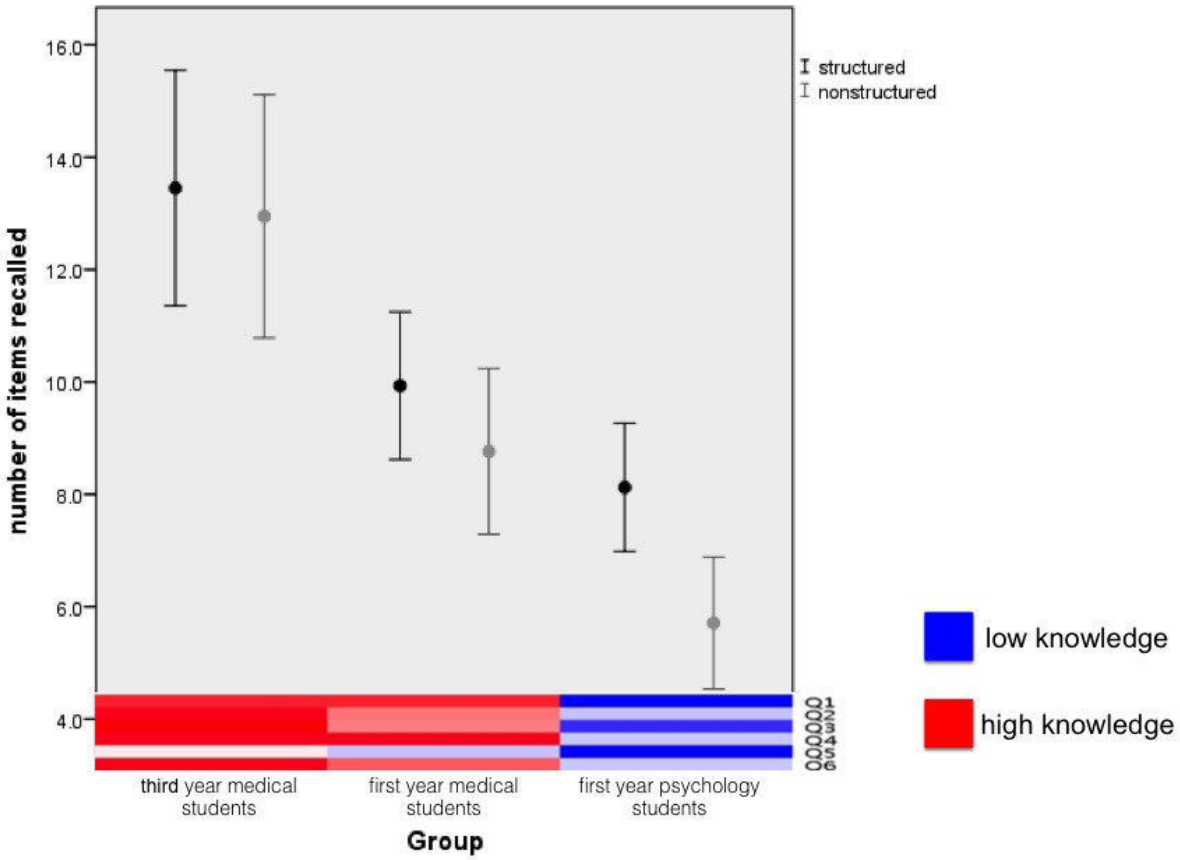

Figure 4. Number of items recalled by participants in the structured and non-structured conditions, separately for each group. The heatmap below represents the level of medical knowledge (percentage of correct answers in Q1-Q6).

5.2.2. Medical Knowledge. A Mann-Whitney U-test of differences in participants' medical knowledge confirmed that the three groups had different degrees of expertise in the area: *first year psychology students'* performance in each of the six multiple choice questions was significantly worse than that of *third year medical students* or *first year medical students* (Table 7). Comparison of the percentage of correct answers provided by the two groups of medical students (Table 6) shows that the *third year medical students* performed better in four of the six questions and equally well in the remaining two. However, the *U* test analyses showed a significant difference between these two groups only in one question (Q3; see Table 7).

Table 7

Results from Mann-Whitney U-tests of Differences in Participants' Prior Medical Knowledge

	First year medical students* vs. *first year psychology students		***First year medical students* vs. *third year medical students***		***First year psychology students* vs. *third year medical students***	
	U	*P*	*U*	*P*	*U*	*P*
Q1	1552	< .01*	1891	.99	623	< .01*
Q2	3722	< .01*	1705	.10	1352	< .01*
Q3	2619	< .01*	1638	.02*	799	< .01*
Q4	3443	< .01*	1881	.87	1374	< .01*
Q5	2673	< .01*	1675	.18	878	< .01*
Q6	3691	< .01*	1744	.17	1373	< .01*

Note: * indicate statistically significant differences between the two groups tested.

5.2.3. Subjective Measures and Additional Covariates. T-test analyses of participants' subjective ratings showed that participants in the structured condition rated the quality of communication significantly higher than did participants in the non-structured condition on all three attributes: comprehensibility of the physician, structure of the dialogue, and willingness to recommend the physician to friends and relatives (overall as well as across

the three subgroups; Table 8 and Figure 5). No differences were observed in the ratings of current mood (Table 8). Among *first year psychology students*, reported attention levels were significantly lower in the NS condition than in the S condition. However, no corresponding differences between the conditions were observed for *first year medical students* or *third year medical students* (Table 8).

The ANCOVA revealed the following (Table 9): The main effect of group on the number of recalled items remained statistically significant with control for either covariate (current mood, attention level). The main effect of condition on the number of recalled items remained statistically significant with control for current mood and marginally statistically significant with control for level of attention. The interaction "condition x group" remained statistically non-significant with control for either covariate. Thus, the main effects "condition" and "group" as well as their interaction "condition x group" proved to be independent from the two covariates.

Table 8

Results from t Tests of Differences in VAS Ratings

	Overall S > NS				***First year medical students* S > NS**				***First year psychology students* S > NS**				***Third year medical students* S > NS**			
	T	*Df*	CI	*P*	*T*	*df*	CI	*p*	*T*	*df*	CI	*p*	*t*	*df*	CI	*p*
Comprehensibility	7.76	186	1.67-2.84	<0.01*	5.36	95	1.43-3.12	<0.01*	4.59	96	1.09-2.76	<0.01*	3.70	37	1.19-4.06	<0.01*
Dialogue structure	11.50	155	2.81-3.99	<0.01*	7.82	62	2.66-4.49	<0.01*	6.38	58	2.08-3.98	<0.01*	5.70	37	2.41-5.10	<0.01*
Willingness to recommend	6.43	232	1.49-2.80	<0.01*	4.86	95	1.44-3.43	<0.01*	2.43	96	0.24-2.37	0.02*	4.61	37	1.81-4.70	<0.01*
Current mood	-0.78	232	-0.63-.027	0.44	-0.51	95	-0.91-0.54	0.61	-0.04	96	-0.74-0.72	0.97	-1.07	37	-1.57-0.48	0.30
Level of attention	1.12	232	0.04-0.97	0.04*	0.65	95	-0.46-0.92	0.52	2.24	96	0.10-1.63	0.03*	0.66	37	-0.76-1.50	0.51

Note: * indicate statistically significant differences between the two groups tested.

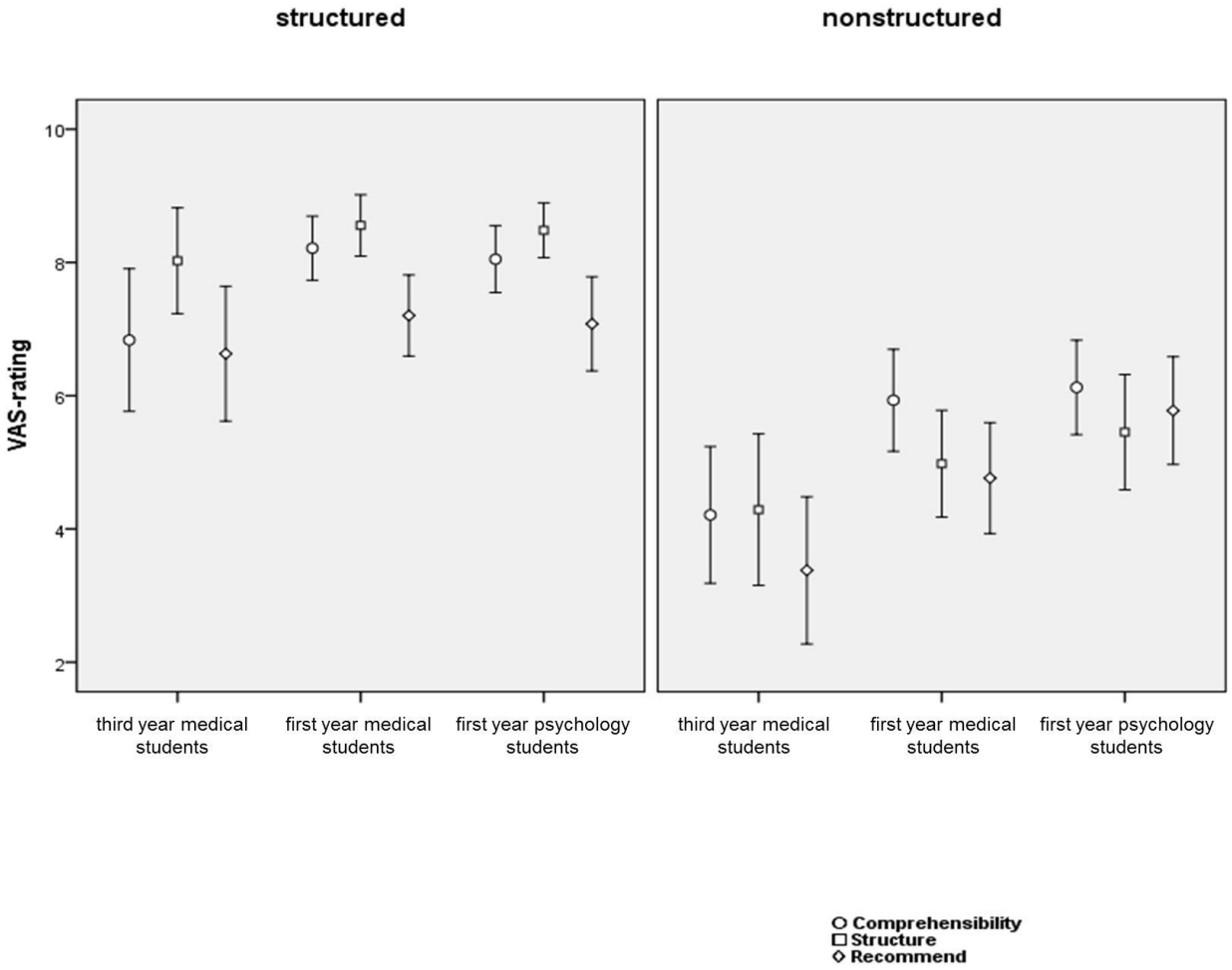

Figure 5. Participants' ratings of the comprehensibility of the physician, the structure of the dialogue, and willingness to recommend the physician to friends and relatives as a function of whether they viewed the structured or the non-structured video

Table 9

Results from the ANCOVA with main effects of condition (c) and of group (g) and their interaction condition x group (c x g); and current mood and attention level as covariates

	current mood			attention level		
	C	**G**	**c x g**	**c**	**G**	**c x g**
F	4.51	27.8	0.77	3.25	28.6	0.59
df	1, 227	2, 227	2, 227	1, 227	2, 227	2, 227
p	0.035*	<0.01*	0.46	0.073	<0.01*	0.55
η_p^2	0.019	0.20	0.007	0.014	0.20	0.005

Note: * indicate statistically significant differences between the two groups tested.

6. General discussion

In emergency medicine, considerable advances have been made during the past decades in diagnosing and treating patients (Vincent et al., 2006). By contrast, disproportionally little research has been conducted regarding physician-patient-communication. However, providing information to patients on discharge from the ED to home is an essential component of quality care provision for ED physicians and a fundamental right of all patients being discharged. Therefore, this dissertation project has been initiated to examine the specifics of physicians' and patients' agendas of the integral components of such communications and to investigate ways to render them suchlike to improve patients' understanding and memory of it.

In this general discussion, the results of the studies presented in this dissertation are discussed. The structure of this chapter is as follows: first, we provide a brief overview of the main results gained through this project (6.1.). Strengths and weaknesses of the research are discussed in general (6.2.) and in context of the existing literature (6.3.). Then, implications for practice are derived from the results (6.4). Finally, unanswered questions will be stated and areas where further research is mandated are described (6.5.).

6.1. Overview of Principle Findings

Throughout the four studies, our aims were:

- To examine the number of items physicians deem crucial in a discharge communication and the time estimated to be necessary presenting them (preliminary study).
- To assess physicians' and patients goals concerning such communications (study 1).

- To test, using students with little to no prior medical knowledge (*first year psychology students*) as proxy patients, the potential of information structuring in contributing to a higher recall capacity (study 2) and
- To assess, using three groups of students with different levels of prior medical knowledge (i.e*., first year psychology students, first year medical students, and third year medical students*), whether potential differences in recall capacity interact with the degree of previous knowledge (study 3).

Over all four studies, our key results are the following:

- Preliminary study

  Physicians from different specialties (internal medicine, cardiology, and emergency medicine) defined a large number of items (on average 36 of the overall 81 provided) as necessary to be given to a patient discharge from the ED. Experts rated the time necessary to communicate this subset to be 44.5 minutes - almost three times the preset 15 minutes.

- Study 1

  Physicians and patients strongly overlap in their assessment of what ought to be conveyed in a discharge communication: Nearly all items identified by the majority of physicians as important were also endorsed by the majority of patients. Specifically, about four in five of the items endorsed by the majority of physicians were rated as important by more than 75% of patients. Three expert physicians classified the items chosen by the two groups into five exclusive categories, namely "**In**formation on diagnosis", "**F**ollow-up suggestions", "**A**dvices on self-care", "**R**ed flags", and "**c**omplete **T**reatment", from which we generated the mnemonic acronym "InFARcT".

- Study 2

Overall, of the 28 items discussed in both the structured and the non-structured communication, *first year psychology students* recalled mean 7.11 items. However, information structuring proofed to be beneficial in terms of students' recall capacity: students in the structured condition recalled mean 8.12 items, whereas students in the non-structured condition recalled mean 5.71 items (p=0.004).

- Study 3

  Study 3 yielded several results: first, students overall recalled on average 9.12 items - about one third of the 28 items presented, illustrating that the ability of the human brain to encode and retain information is limited. Second, prior medical knowledge boosted recall performance. The *first year psychology students* (with the least prior knowledge) recalled fewer items (7.11) than the *first year medical students* (9.49), who in turn recalled fewer items than the *third year medical students* (13.23). Third, although the interaction proofed to be non-significant, the magnitude of the effects of information structuring seems to vary systematically by the degree of medical knowledge: It is greatest with least prior knowledge, and disappears gradually with increasing expertise.

6.2. Strengths and Weaknesses of this Research

First of all, the results of our preliminary study show that efforts to define the quantity of discharge information are anything but trivial, as the average number of items chosen most likely is way beyond the capacity of typical patients to recall information. Even though study participants in the preliminary study were told to choose items that could be given within a 15 minutes interaction, the time most likely needed to give this amount of information (as estimated by expert physicians) exceeded the time previously set by a factor of three (45 vs. 15 minutes). These findings suggest that physicians have unrealistic expectations concerning

the amount of information that could be crammed into a 15-minute window dedicated to convey important information to the patient. The extent to which the physicians participating in our study proved to be miscalibrated is surprising in light of the fact that discharge communication represents a routine activity for all our participants.

Besides this, the goal of study 1 was to implement a new method for content definition, using the example of chest pain, one of the most frequent complaints in the ED. Using an iterative procedure involving both "expert" groups (i.e., physicians and patients) and a group of expert physicians, we generated and refined a list of important items to be discussed at discharge. By involving professionals with daily experience of chest pain patients (i.e., cardiologists, internists, and emergency physicians), we sought to bring medical expertise and a focus on feasibility to the process; by involving patients, using a mixed methods approach incorporating elements derived from both quantitative and qualitative traditions, we intended to represent the perspectives and needs of people experiencing alarming symptoms. Three expert physicians classified the items chosen by the two groups into five exclusive categories and we generated the mnemonic acronym "InFARcT" from the first letter(s) of each category. The letters of the acronym serve as retrieval cues to items that need to be remembered. For instance, the acronym HOMES helps to remember the Great Lakes: Huron, Ontario, Michigan, Erie and Superior.

The instrument used in study 2 and 3, namely information structuring (along the "InFARcT"-acronym), was a newly designed tool that had not been previously tested to improve recall capacity after discharge instructions. Studying its effect experimentally in the ED would be demanding and potentially stressful for ED patients. In a first step, we therefore decided to use students as proxy patients. Our results suggest that in particular people with no prior medical knowledge would benefit substantially from a structured presentation of discharge information. In contrast, structure appears to have no or little benefit for recall in

people with prior knowledge. It seems that prior knowledge enables the receiver of information to store it efficiently, even when its presentation lacks structure. Therefore, as of the three groups studied, the group of *first year psychology students* is most similar to patients who present to the ED with little to no disease-relevant knowledge, structuring discharge information may be a practical tool for ED physicians that also benefits real patients.

Besides these strengths, this dissertation project certainly has limitations. First, the situations in which physicians had to choose relevant items (i.e., in a quiet room sheltered from the busy ED-atmosphere) and in which students had to recall the content of the video-taped discharge communication (i.e., University auditoriums) are artificial. Thus, the results may not be easily transferable to situations where physicians must make decisions under time pressure or where real patients must recall the just heard after a real ED-consultation. Second, presenting a menu of 81 items from which physicians (in the preliminary study and study 1) could choose may have tempted physicians to select more (or less) and different items than they otherwise would have selected. Third, defining the content of ED discharge instructions and providing a mnemonic acronym for physicians resulted in a communication-procedure that is standardized to a certain degree. However, standardized procedures can never replace individualized communications. A protocol should never compete with or even replace patients' questions. Also, patients' fears must be perceived, addressed, and discussed and good discharge communication requires tools and communication skills such as mirroring. Fourth, with respect to the generalization of our findings, one might argue that the sample of *first year psychology students* that participated in study 2 and 3 is not representative of the average patient presenting to the ED with chest pain. An open question remains whether this induced a bias in favor of the intervention or whether the results have to be viewed with special caution. *First year psychology students* are probably better trained and capable of storing new information than the typical 60 year old patient with less formal education.

Therefore, results might actually overestimate the number of items typical patients will recall, and on the other hand underestimate the benefit of structure. One might also consider whether students are less motivated than real patients to recall information because they are not affected by the problem that is addressed in the physician's utterances. Furthermore, patients with chronic conditions may have more pertinent knowledge and better be able to integrate even unstructured information into existing knowledge structures and categories. And finally fifth, another limitation concerns the presentation of information in these two studies: To be able to standardize the presentations, we employed contrived video clips rather than real-life interactions. Real-life communication offers many opportunities to tailor information and speed of delivery to recipients' reactions: Subtle cues can indicate the need to slow down the delivery or to speed up because the recipient is more knowledgeable than the sender assumes. The staged interaction's representativeness of a real situation in the ED may thus be questioned.

6.3. Strengths and Weaknesses in Relation to the Existing Literature

Shown by the findings of our preliminary study, the number of crucial items selected by physicians far exceeded the amount of information humans could be expected to process and retain, assuming normal working memory capacity (Cowan, 2001). It is practically impossible that any patient will recall 36 pieces of information. Here the problem is that it is unknown which items are recalled and which ones are forgotten; if this is a random process, there is a good chance that a potentially life-saving piece of information is lost. We can only tentatively offer the explanation that the selection of items physicians actually communicate is not a conscious process after careful consideration of the importance of single items. It is well possible that in reality physicians mention what comes to their mind. Even if our experts (who estimated the time necessary to communicate each item of the 81 item list) grossly

overestimate the time per item and physicians could actually communicate all of them, the sheer number clearly exceeds the limits of normal working memory capacity.

In stark contrast to the scarcity of research about real patients' ability to recall information provided during ED discharge, memory capacity in healthy volunteers has been extensively studied. Although the precise bounds of working memory are still discussed, the fact that its capacity is limited, is undisputed, ranging from seven plus/minus two (Miller, 1956) to four plus/minus two information chunks (Cowan, 2001). In light of these mnemonic limits, it is notable that the physicians in our study selected, on average, 37 (internists) and 32 (emergency physicians) items, respectively, to be communicated. The majority of these items were quite complex in nature, possibly encompassing more information than could be grouped into a memory chunk (e.g. the item "Stress that the patient should present immediately to the ED if he experiences chest pain not responding to nitroglycerine"). One possible way to overcome the gap between physicians' unrealistic expectations on one hand and ED-reality and human brain limitations on the other, is to provide written information (Johnson & Sandford, 2005); however, this is not always possible when information needs to be tailored to a specific patient, patient literacy is low, or diagnoses are varied or unclear - as is often the case in ED patients. Furthermore, in EDs in Switzerland and most European countries, verbal discharge communication without written instructions is the standard of care. And even if Johnson and Sandford's review (2005) recommends the use of both verbal and written health information, studies have also shown that written discharge instructions might not be the best solution: For example, a well conducted study (Damian & Tattersall, 1991) in which oncologists randomized patients into a control group receiving oral discharge information, and an intervention group receiving personalized, written discharge information, found that the median (range) number of recorded items per patient was five (four to nine) in

the control group and six (three to 13) in the intervention group, the difference being non-significant.

The aim of study 1 was to implement a new method for content definition, using the example of chest pain, one of the most frequent complaints in the ED. Although chest pain, relative to other symptoms, is a well-defined and well-recognized symptom in the general population (Mata, Frank, & Gigerenzer, 2014), a multitude of information could, in theory, be conveyed to a chest pain patient who is being discharged. Three expert physicians classified the items chosen by the two groups into five exclusive categories. These categories are similar to the seven categories used in a recent study on written discharge communication (Vashi & Rhodes, 2010); however, the latter study gave no principled account for the choice of the categories. The same holds true for another recent study using written discharge information (Arnold, Goodacre, Bath, & Price, 2009). Again, four of five of their categories were identical with our classification system. The authors of this study concluded that written discharge information can reduce anxiety and depression, improve mental health and perception of general health, but does not influence satisfaction with care or other outcomes (Arnold et al., 2009). More generally, a recent systematic review on the role and effectiveness of written discharge information found no robust evidence that it affected patient satisfaction or adherence (Raynor et al., 2007). Even if written information were the key to higher patient satisfaction and better health outcomes in patients with chest pain, physicians need help to decide which content has the potential to improve patient outcomes. In the absence of any longitudinal studies, one way to determine the ideal content of written communication is by consulting the two parties involved, as we did for verbal communication. And even if written discharge information is the standard of care, a normal ED discharge will conclude with verbal communication. Physicians should not waste this opportunity to communicate and to educate.

A review study (Stewart, 1995) found a correlation between effective physician-patient-communication and improved patient outcomes, with a multitude of interventions and instructions emerging to be beneficial. However, all of the analyses reviewed assessed the form of the physician–patient interaction; none assessed the content. Structuring the content of ED discharge communication and offering a mnemonic aid could improve patients' outcomes. For instance, parents of children with otitis media who received standardized discharge instructions were better able to recall information than were parents who received non-standardized instructions (Isaacman et al., 1992). By the same token, a standardized approach to physician–physician interaction using the DINAMO-acronym led to a significant decline in missing or wrong information detected after handover (Rudiger-Sturchler, Keller, & Bingisser, 2010).

We could show through study 2 that a simple communication technique, i.e. structuring, improves recall of medical information. To our knowledge, this is the first cognitive intervention in a clinical setting that proves the hypothesis of authors like Doak et al. (1998) and Ley (1979) who argued that structured information would be easier to recall than non-structured information. Compared to our analysis, these authors did not provide strong evidence to support this hypothesis. The fact that individuals retrieve information much better when they can organize information along familiar structures has convincingly been investigated in master chess players who recall the position of pieces on a chess board with an incredible precision of 93% after a presentation time of only five seconds (de Groot, 1965), and far much worse when they are asked to recall the position of randomly placed pieces (Gobet & Simon, 1996).

The results of study 3 indicate that in particular people with no prior medical knowledge would benefit substantially from a structured presentation of discharge information, whereas structure appears to have no or little benefit for recall in people with

prior knowledge. It seems that prior knowledge enables the receiver of information to store it efficiently (consistent with the literature on the impact of prior knowledge on memory (Brod et al., 2013)), even when its presentation lacks structure. The relationship between structure and subsequent recall performance has previously been studied, yet in very different circumstances (Epstein, 1967; Hannafin, 2004; Traupmann, 1975). Our results converge with previous findings: structure results in better recall than lack of structure, in particular when no pertinent prior knowledge is accessible. Hannafin (2004) found that high- and medium-ability (and not low-ability) students performed better in a structured program than in an unstructured program. In contrast to these findings, we did not assess students' ability but rather their preexisting knowledge in the field. Further studies might address a combined evaluation of these parameters.

6.4. Implications for Practice

From the results of the studies presented in this dissertation, several main implications for practical physician-patient-communication can be derived. First, the results of our preliminary study demonstrate that, given the limited recall capacity of the human brain and the limited time available on the ED, physicians must communicate less information than they ideally would like to convey. This clearly shows that physicians need help to decide which content has the potential to improve patient outcomes. Therefore, defining the content of discharge information for the most frequent diagnoses, such as chest pain, seems especially important for ED physicians, and was therefore the main purpose of study 1. The content of this communication should consist of categories and items that are limited in number, easy to retrieve (for both physicians and patients), and conducive to grouping into high-level, meaningful categories, as chunking increases the likelihood that people can reproduce the information they have received (Gobet et al., 2001; Li et al., 2013). One possible way to help physicians remember the essential content is to offer a mnemonic device. Thus, the

"InFARcT"-acronym generated in study 1 could serve physicians as a retrieval aid for categories and items that need to be discussed in a communication. Furthermore, this acronym is not a neologism but represents a word with an established meaning and highly pertinent to patients with acute chest pain.

Concerning the two studies conducted to test a possible effect of the information structuring technique (structuring the communication along the generated "InFARcT"-categories) on students' recall capacity, two findings merit special attention: First, the fact that *first year psychology students* recall only 7 and even *third year medical students* only 13 of the overall presented 28 items in the two videos suggests that probably all patients are doomed to be over-flooded with information in physician-patient-communications in general. Consequently, these results, again, indicate that clinicians must decide which information is absolutely crucial to deliver and which information can be tailored to the patient's individual needs. This calls for action from the clinicians' side: in addition to the development of extensive information material, a consensus must be reached on the essential information in any given disease or diagnosis, or treatment. Second, more research is needed on the benefits and limits of the book metaphor, and on the efficacy of training programs in the use of this technique. Anyhow, as the group of *first year psychology students*, which proofed to profit from the communications' implemented structure, is most similar to real-life ED patients with little or no medical knowledge, using the "book metaphor" to structure discharge information may be a practical tool for ED physicians that also benefits real patients.

6.5. Unanswered Questions and Future Directions

Our results indicate several avenues of future research. First, research efforts should be directed at devising and evaluating strategies to help physicians implement the content elaborated in study 1 and the structuring-technique tested on students in study 2 and 3 in real discharge communications and assessing its impact on real patients' outcomes such as

satisfaction, stress, readmission rates, quality of life, and acquisition of disease-related information. Studies assessing the effects of various forms of physician communication on patient outcomes and combining elements of both content and form are highly warranted. Second, extensive work is needed in the field of patient recall. Given the high number of items selected as important by both patients and physicians, how and to what extent could patients' memory for the information discussed during discharge be maximized, besides our suggested information-structuring? Investigations of whether well-established mnemonic techniques, such as the method of loci (Bower, 1970) or the testing effect (Roediger & Karpicke, 2006), and of course our information-structuring technique, could enhance real patients' ability to recall instructions are warranted. Third, although we have found a positive effect of information structuring on naïve students' recall, we cannot provide insights into students' comprehension of the transmitted information nor did we analyze yet which of the 28 items provided were recalled more and which less frequently. However, applying the structuring technique could also have an impact on the comprehensibility of the information conveyed and on the recall order and frequency of the items, as the receiver is given more time and a framework to incorporate the new information in preexisting systems. Studies examining the book structure's effect on both recall capacity and understanding could be highly rewarding. Fourth, because communication is an interactive process, qualitative studies that evaluate the physicians' degree of actively involving the patient into the communication when using or not using the information-structuring-technique, would be particularly helpful. Although difficult to gauge, qualitative measures can provide a deeper understanding of patients' subjective perceptions and feelings. Could structuring the communication also support the physician in encouraging the patient to ask questions and to reach shared decisions, through deliberately incorporating pauses and confirm the patient's understanding? Shared decision making, leading to agreement between patient and physician, is a highly

crucial part of this interactive process that requires full description of the kind that is possible only in qualitative research approaches.

Fifth, on a more general level, studies to explore physicians' ability to estimate patients' recall capacity, as well as specific ED-visit factors and patient characteristics that are associated with poor recall capacity might be interesting to conduct. For the physicians, being aware of factors that might contribute to a low patients' recall capability could help them considering it and adapting the communication accordingly. Sixth, the neurobiological representation and neuroanatomical location of structured vs. non-structured information processing and its recall has so far not been studied. It might be of great interest to find out which different neuronal areas are activated when study subjects are either exposed to structured or unstructured memory items. Although neuronal networks work in a quite different, associational mode, the input of a structured piece of information might well elicit different neuronal activation than its merely non-structured counterpart with the same content. The final representation of the acquired knowledge which is the basis for recall and therefore output of the information could either be located in the same group of neurons or be represented by different neurons since the input is acquired in a different associational loop. How well previous knowledge about memory items interferes with acquiring new pieces of information, and how emotions or distress in an emergency setting would influence the neuronal representation of the gained information, remains a matter to be studied with functional neuroimaging or other applied methods.

7. Conclusion

Physicians in our preliminary study proved to be miscalibrated with regard to the number of items they could realistically discuss in an ED discharge communication. Therefore, a first conclusion derived from that result is that, assuming that physicians simply cannot cram 36 items into a window of 15 minutes, physicians must communicate less information than they ideally would like to convey; this suggests that defining which information is so relevant that it *must* be remembered by patients is highly urgent. The strong consensus between physicians and patients concerning the essential elements of such communications that was observed in study 1 therefore provides a good basis on which the content-items of ED discharge communications could be defined and grouped into categories. The letters of the thereby generated InFARcT-acronym can serve as retrieval cues to items that need to be remembered. Defining and structuring the content of discharge information for the most frequent diagnoses, as we did for chest pain, seems especially important for ED physicians, as stress and time constraints jeopardize optimal communication and as the vast majority of residents in this field cannot call upon extensive experience.

The informed patient is a prerequisite for shared decision making in health care because s/he must be conscious of any consequences of a given diagnosis or a certain treatment. Thus, information must be recalled and stored in memory to be able to build decisions upon knowledge. We could show that a simple communication technique, i.e. structuring information according to the "book metaphor", improves students' recall of medical discharge information; in particular students with no prior medical knowledge benefit substantially from a structured presentation of discharge information. However, the fact that students with no prior medical knowledge recall only seven, and even advanced medical students only 13 of the overall presented 28 items suggests that probably all patients are doomed to be over-flooded with information in patient-physician communications in general.

Future research evaluating the benefits of structure in the presentation of discharge information will, of course, need to involve real patients presenting to the ED and real physicians treating them and interacting with them. In general, we conclude that there is an obvious need to train physicians in skills of implementing effective discharge communication, in content and form, as this represents a valuable and rare opportunity to communicate, and thereby to foster better outcomes. It should not go to waste.

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Annex

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Discharge communication in the emergency department: physicians underestimate the time needed

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Summary

OBJECTIVE: In an emergency department, discharge communication represents a key step in medical care. The efficiency of this doctor-patient interaction could be hampered by two bounds: The limited time in emergency care and patients' mind's limited capacity to encode, store and maintain information. Such limitations are the focus of this study. Specifically, we examine the number of items physicians deem crucial in a discharge communication and the necessary time estimated to present them.

METHODS: A vignette of a patient with chest pain was presented to 47 physicians (38 internists, 9 emergency physicians). Physicians were offered a list of 81 items possibly conveyed to patients and asked to select the important ones assuming a discharge interaction of 15 minutes. Additionally, 7 experts estimated the time required to communicate each item.

RESULTS: Physicians' mean clinical experience was 10.1 years. From the list of 81 items, physicians selected, on average, 36 items (Range: 20–57). Experts rated the time necessary to communicate this subset to be 44.5 minutes – almost three times the preset 15 minutes. While emergency physicians, relative to internists, selected an insignificantly lower number of items (31.6 ± 6.2 vs. 37.4 ± 10.2), the time estimated for communicating the information was significantly shorter (36.9 ± 6.3 vs. 46.4 ± 13.5).

CONCLUSIONS: Physicians in our study proved to be miscalibrated with regard to the number of items they could realistically discuss in a discharge communication. We conclude that there is an obvious need to train physicians in skills of implementing efficient discharge communication.

Key words: *communication; information-giving; patient instruction; physician-patient interaction*

Introduction

Discharge from the emergency department (ED) is a period of high vulnerability for patients [1]; they might run the risk of further clinical deterioration, suffer from a misdiagnosis, if the diagnostic process was not exhaustive, or experience side effects from newly installed drugs [2]. Compounding these risks, deficits in communication and information transfer at hospital discharge are common and may adversely affect patient care [3]. Unfortunately, there is no evidence-based protocol concerning the amount of information physicians should aim to convey to patients. Therefore, the present investigation takes a first step into examining the attributes of good discharge communication. Specifically, we ask physicians to identify the crucial items they would present throughout a discharge communication limited to 15 minutes. The ability to accurately predict the amount of information that can be conveyed in a limited time window is especially important in the context of the busy ED environment, in which a myriad of factors conspire to make patient-doctor communication especially difficult to implement, including unpredictable workload, ED crowding, simultaneous care for multiple patients, high level of uncertainty, time constraints, absence of long-term relationship with patients, and lack of feedback about outcomes of care [4]. Importantly, the practice of emergency medicine is characterised by episodic contact with patients and difficulties in establishing continuous care [5]. Furthermore, in a previous study, ED residents were found to devote far more time and attention to the collection of information than to information giving, suggesting that the latter goal receives less attention [6]. Patients treated in the ED are often presented with complex instructions at discharge [7]. Consequently, a precious opportunity may be missed during which physicians could effectively recapitulate the results of the evaluation in the ED, spell out the final working diagnosis, and recommend follow-up and treatment options [8]. Effective communication during discharge is important because the patient's degree of accurate knowledge and insight into his or her medical condition is likely to foster compliance, patient satisfaction, adequate disease management and reduce anxiety [9] and the incidence of frequently occurring drug-drug-interactions at hospital discharge [10]. As time is a limited resource in hospitals in general and in EDs in particular, sharing information

with patients will inevitably be traded-off with the time requirements of other tasks [11]. Interestingly, there is no empirical basis on which to decide, which information is essential and must be given to patients to keep them well-informed or at least to avoid harm. From the patient's perspective a definition of crucial information would also be greatly needed. Time, however, is not the only constraint. Human working memory is limited in the number of items it can hold. In his landmark publication, Miller [12] found that humans can recall only seven chunks of information (plus or minus two). Several factors may contribute to even lower memory capacity – Cowan [13] described the "magic four" chunks recalled in a more complex type of memory experiment which is more likely to be representative of the situation in which patients find themselves. Yet, besides these more experimental investigations on general regularities of human working memory, little is known about patients' ability to subsequently recall instructions received during hospital discharge [14]. A study of Chau et al. [15] showed that even immune-compromised patient's knowledge of oral drugs at discharge was merely moderate. Using telephone interviews to gauge the ability to recall discharge instructions, another study [14] found that many patients were unable to even name their diagnosis or list risk factors as contributing causes. Examining elderly patients' comprehension of discharge instructions, a further study found that 21% did not understand their diagnosis, and 56% failed to comprehend their return instructions [16]. Finally, Isaac et al. [17] observed that less than half of the important discharge information, including medication details and indicators of worsening of the patient's clinical status, was recalled during an exit interview.

These few available findings suggest that there is ample room for discharge communication to be optimised. One component of better communication is for physicians to be well aware of the amount of information that can realistically be conveyed within an available time window. They might select necessary information with the general practitioner in mind, with whom the patient will connect after discharge and who probably is in better position to manage patients' information and therapy needs in the longer run [18]. In order to examine the extent to which physicians are well calibrated to the amount of information and time needed, we undertook a descriptive preliminary study that probed the number of crucial items physicians, in theory, aimed to cover in a typical discharge communication and the time required to, in reality, do so.

Methods

Pilot study

A pilot study was conducted to determine the time taken by emergency physicians to communicate information at discharge. To this end, real episodes of discharge communication were recorded. Each physician was instructed that the respective episode was to be analysed for content; they were not told that time used was also of concern. Having received informed consent from patients and physicians, recordings were transcribed and in fact analysed for the time used. Averaged across 20 episodes involving patients presenting with acute chest pain, discharge communication took 6 minutes. We therefore decided to use the 95% percentile of the distribution of interview times and defined the time limit for the main investigation as 15 minutes.

Setting and procedure

The study was conducted in a quiet conference room at Basel University Hospital, Switzerland. The hospital is a 700-bed primary and tertiary care university hospital and the ED treats over 41,000 patients per year.

The following case vignette of a common clinical problem was presented to physicians in written form. Subsequently, they answered a questionnaire containing 81 items possible to discuss at discharge (see Appendix). Physicians were asked to first read the case history, and then to *choose* the crucial items they would aim to communicate during a *15-minute* discharge communication:

Case vignette

A 63 year old male patient, accompanied by his wife, presented to the ED because of left-sided chest pain. At presentation he was free of symptoms. Chest pain was associated with exertion (walking uphill, climbing stairs) and subdued when resting. He noted progressive exercise intolerance for the past four weeks. Neither dyspnea nor orthopnea were reported. His past medical history consisted of hypertension, diagnosed 5 years ago, and an ongoing smoking history of 20 pack-years. His father died after a stroke at age 78, and his mother suffered from hypertension and diabetes mellitus II for several years. His present medication consisted of a calcium channel blocker. Even though myocardial infarction was excluded by repeated high-sensitive troponin and electrocardiogram, further work-up was warranted because of typical angina symptoms and a high degree of likelihood of coronary heart disease.

For further work-up a myocardial scintigraphy was planned the following week (date and time known), the recommended therapy consisted of aspirin and beta-blockers; nitroglycerin was given in case of chest pain, and a visit with his family physician was to be scheduled in the meantime.

Independently, seven experts were asked to estimate the time needed for communicating each item featured on the questionnaire. Experts were instructed to only consider the time spent communicating the information and omitting the time consumed by responding to a patient's questions (examples given in table 1). Estimated times for all items were averaged across the seven experts' ratings. Then we combined the experts' time estimates with each physician's personal selection of crucial items. Specifically, we multiplied, separately for each physician, each selected item with the experts' mean time estimates for this item. Across a physician's chosen set of crucial items, we thus estimated the total time required to actually communicate these items.

Participants

Out of total of 80 physicians working at University Hospital of Basel, whose specialty (emergency medicine, internal medicine, and cardiology) made them suitable for this study, 47 agreed to participate. From those, 9 worked as emergency physicians and 38 as internists (cardiology

staff and internal medicine staff and residents taken together). Experts were chosen by their experience of more than twelve years in the field, and their staff position involving student teaching and training of junior physicians.

Statistical analysis

Collected data was analysed with SPSS (version 17.0). Mean and range of required time estimates and number of items chosen were assessed for each group. An independent-samples t-test was conducted to assess differences between groups.

Results

Mean (SD) clinical experience of the 47 physicians was 10.1 (8.3) years. Among these, 9 were currently working as emergency physicians, with a mean (SD) clinical experience of 12.2 (6.5) years. The remaining 38 physicians were working in internal medicine and cardiology (henceforth called "internists"), with a mean (SD) clinical experience of 9.6 (8.7) years. The experts' mean (SD) clinical experience in the field was 18.1 (7.7) years.

Out of the 81 items provided, an overall mean (SD) of 36.3 (9.8) was chosen (45%), with a range of 20 to 57 items. Mean (SD) estimate of the time required to communicate these items was 44.5 (12.8) minutes (range 25–74 minutes). As shown in table 2, the mean (SD) number of items chosen by internists was 37.4 (10.2), and 31.6 (6.2) chosen by emergency physicians, respectively. The difference between the two groups proved to be not statistically significant ($t_{(45)} = 1.64$, $p = 0.11$, d = 0.41). The distribution of the number of items, chosen by internists and by emergency physicians, respectively, is shown in figure 1.

The mean (SD) time derived for communicating the discharge information, selected by the physicians, amounted to 46.4 (13.5) and 36.9 (6.3) minutes for internists and emergency physicians, respectively (table 2). This is 3.1 and 2.7 times longer than the preset time window for the task of discharge communication. This difference between groups proved to be significant ($t_{(45)} = 2.04$, $p = 0.047$, $d = 0.73$).

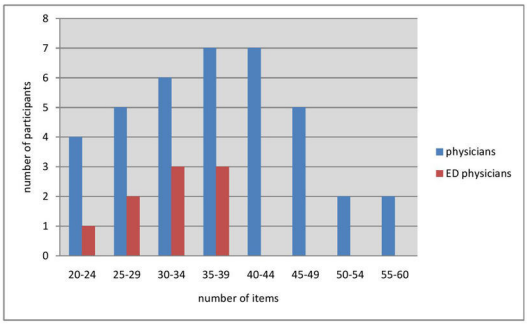

Figure 1

Number of items, chosen by physicians and by ED-physicians respectively.

Discussion

According to our findings, physicians from different specialties (internal medicine, cardiology, and emergency medicine) choose a large number of items deemed necessary to be given to a patient with chest pain at discharge from the ED. Even though study participants were told to choose items that could be given within a 15 minutes interaction, the time most likely needed to give this amount of information exceeded the time previously set by a factor of three (45 vs.15 minutes, the latter being instructed in written and oral form). First of all, these results show that defining relevant items is a difficult task with experienced physicians choosing quite different items, and that the average number of items most likely is way beyond the capacity of typical patients to recall information. These results are all the more impressive as in reality discharge communications are likely to be even shorter than the time window we presently assumed. A study analysing audiotaped ED discharge communications observed an average length of 76 seconds (range 7 to 202 seconds) [6]. Our own pilot study, based on a small sample of 20 communications, found an average duration of 6 minutes. Furthermore, the number of crucial items selected by physicians far exceeded the amount of information humans could be expected to process and retain, assuming normal working memory capacity. Taken together, these findings suggest that our physicians had unrealistic expectations concerning the amount of information that could be crammed into a 15-minute window dedicated to convey important inform-

Table 1: Examples of items and the time for information-giving as estimated by experts.

• To specify the suspected diagnosis • To address coronary risk factors	1 minute
• To specify why further examinations are necessary • To explain alternatives to the proposed investigation	2 minutes
• To give information about the differential diagnosis • To explain the association of the symptoms with the suspected diagnosis	3 minutes
• To explain the pathophysiology of coronary heart disease • To give information about the consequences in case of a positive stress test	4 minutes

Table 2: Results.

		Mean	SD
Internists (38)	**No of items chosen** **Time needed (min)**	37.4 46.4*	10.2 13.5
Emergency physicians (9)	**No of items chosen** **Time needed (min)**	31.6 36.9*	6.19 6.34

*p <0.05

ation to the patient. The extent to which our physicians proved to be miscalibrated is surprising in light of the fact that discharge communication represents a routine activity for all our participants.

Even though the literature on patient information has yielded different figures, it is practically impossible that any patient will recall 36 pieces of information. Here, the problem is not so much that some items get lost, the problem is that it is unknown which items are recalled and which ones are forgotten; if this is a random process, there is a good chance that a potentially life-saving piece of information is lost. This study adds to our knowledge by demonstrating that besides training programs teaching the art of giving information, clinicians have to decide which information is so relevant that it *must* be remembered by patients; this should be shorter than the list of over 30 items chosen by experienced physicians in this investigation. How such a reduced list of items should then best be communicated remains to be shown and will require further research. However, to the best of our knowledge, the process of advanced planning of a discharge communication and the process of determining the amount of information to be conveyed and the time needed to do so has not been studied.

In stark contrast to the scarcity of research about real patients' ability to recall information provided during ED discharge, memory capacity in healthy volunteers has been extensively studied. Although the precise bounds of working memory are still discussed, the fact that its capacity is limited, is undisputed, ranging from 7 ± 2 [12] to 4 ± 2 chunks [13]. In light of these mnemonic limits, it is notable that the physicians in our study selected, on average, 37 (internists) and 32 (emergency physicians) items, respectively, to be communicated. The majority of these items were quite complex in nature, possibly encompassing more information than could be grouped into a memory chunk (e.g. the item "Stress the importance of returning to the ED immediately if the patient experiences chest pain not responding to nitroglycerine").

Studies from the US have shown that written discharge information might not be the best solution: For example, a well conducted study [19] in which oncologists randomised patients into a control group receiving oral discharge information, and an intervention group receiving personalised, written discharge information, found that the median (range) number of recorded items per patient was 5 (4–9) in the control group and 6 (3–13) in the intervention group, the difference being insignificant! The factors associated with patient's recall were the mean time used for each item (1.2 min for recalled items), and the content. E.g. smoking cessation was recalled as an item discussed in 76% of all smoking patients, whereas only 11% recalled being instructed about medication.

However, available studies have not examined ED discharge communications, in which physicians usually focus on immediate needs, and the decisions about what information will be conveyed are made in a rather ad hoc manner. One of the urgent future research questions is why experienced physicians, who were unambiguously and repeatedly instructed to plan for a typical 15 minute discharge communication, chose on average over 30 items. Actually conveying this lengthy list of items would either have taken much longer than the allotted time window or the communication would have morphed into a staccato speech. We can only tentatively offer the explanation that the selection of items physicians actually communicate is not a conscious process after careful consideration of the importance of single items. It is well possible that in reality physicians mention what comes to their mind; apparently this takes 6 minutes in our pilot study (with 95% percentile of 15 minutes) – the amount of necessary information increasing only when they are asked to deliberately choose from a given list of items. Even if our experts grossly overestimate the time per item and physicians could actually communicate all of them, the sheer number clearly exceeds the limits of normal working memory capacity. A final disconcerting possible implication of our findings is that, assuming that physicians simply cannot cram 36 items into a window of 15 minutes, physicians communicate less information than they ideally would like to convey.

Clearly, further research is needed to define the ideal quantity and quality of discharge information in the ED by means of outcome studies – the present preliminary report contributes a first step in this direction, highlighting the necessity to realistically plan daily discharge communications.

Limitations

First, one might argue that the situation in which physicians chose relevant items was artificial insofar as no patient was present and as they were sitting in a quiet room sheltered from the busy atmosphere of an ED. However, if they made their choice under conditions that allow for careful consideration, is it likely that any decision made under time pressure would be more rational? Presenting a menu of 81 items from which physicians could choose may have tempted physicians to select more than they otherwise would have selected. In order to try to address this possibility, we have conducted the same analysis with another sample of 9 physicians using a shorter list of 37 items, encompassing items that were chosen by the majority of participants. We found that the mean number of items selected from this reduced list was 25 (range: 17–30), a number still exceeding working memory capacities of most patients.

Second, physicians in Switzerland (and elsewhere) cannot be expected to have profound knowledge of psychology's research on memory and memory limitations. Therefore, the comparison between what physicians would ideally like to communicate and what patients can be expected to process may seem harsh. Yet, the comparison is informative because it indicates a potential mismatch between physicians' ideal of information giving and the reality of patients' limited information processing capacity.

Third, a potential bias is the selection bias: Perhaps, those physicians who were motivated enough to participate were also more vulnerable to act in accordance with concerns of social desirability. Such a concern could simultaneously foster the selection of a larger number of items. Therefore, it would be informative to replicate our study with larger and other samples of physicians in Switzerland and elsewhere.

Taken together, external validity may be questioned by all factors mentioned above – therefore, larger samples in different ED environments should be analysed.

Conclusions

The present study suggests a possible need for training on all levels (residents and staff physicians, cardiologist, internists, and emergency physicians alike) concerning the amount of information to be ideally conveyed in discharge communication. The available literature gives some preliminary hints to the ideal quantity of information. Notwithstanding this generic information, more targeted studies are needed on several levels: First, observational studies could help to describe the actual time (across different medical systems) physicians devote to discharge communication. Second, the ability to recall discharge information needs to be investigated in patients discharged from the ED. Third, and most importantly, studies assessing meaningful outcomes, such as the use of resources (*overuse* due to increased anxiety versus *underuse* due to "overconfident" patients), or even morbidity and mortality are required to determine the quantity and quality of information to be given at ED discharge. This preliminary report may help to ignite more research along these lines.

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Figures (large format)

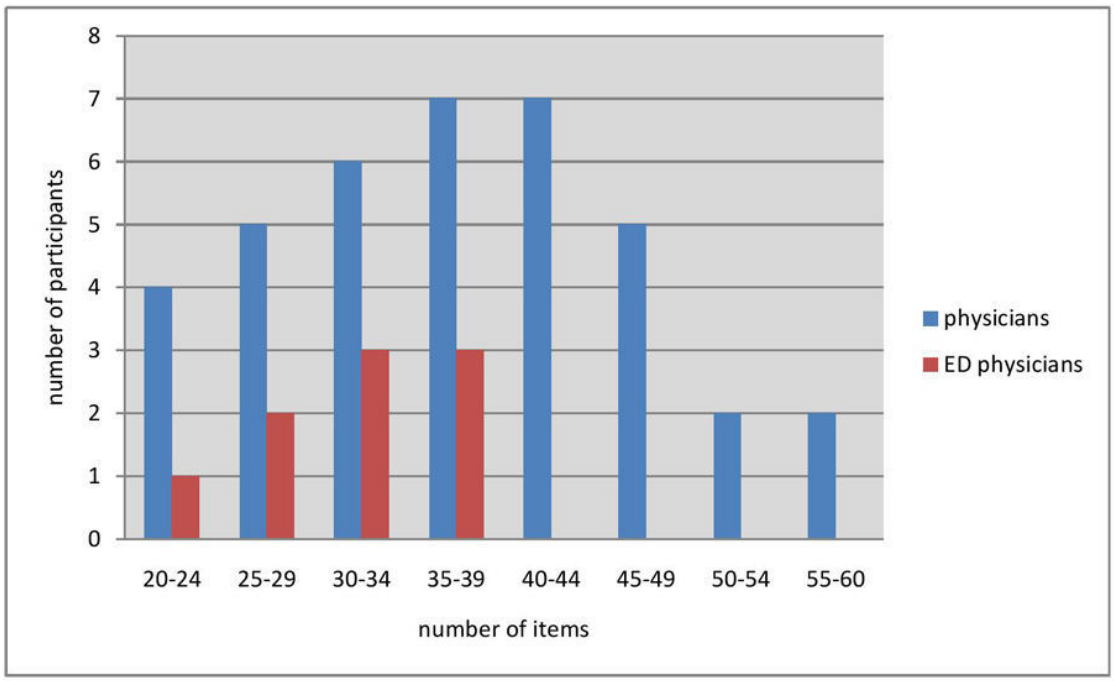

Figure 1

Number of items, chosen by physicians and by ED-physicians respectively.

Running head: Content of ED Discharge Communication

Discharge Communication in Patients Presenting to the Emergency Department with Chest Pain: Defining the Ideal Content

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Abstract

In an emergency department (ED), discharge communication represents a crucial step in medical care. In theory, it fosters patient satisfaction and adherence to medication, reduces anxiety, and ultimately promotes better outcomes. In practice, little is known about the extent to which patients receiving discharge information understand their medical condition and are able to memorize and retrieve instructions. Even less is known about the ideal content of these instructions. Focusing on patients with chest pain, we systematically assessed physicians' and patients' informational preferences and created a memory aid to support both the provision of information (physicians) and its retrieval (patients). In an iterative process, physicians of different specialties ($N = 47$) first chose which of 81 items to include in an ED discharge communication for patients with acute chest pain. A condensed list of 34 items was then presented to 51 such patients to gauge patients' preferences. Patients' and physicians' ratings of importance converged in 32 of the 34 items. Finally, three experts grouped the 34 items into five categories: (1) ***In****formation on diagnosis*; (2) ***F****ollow-up suggestions*; (3) ***A****dvice on self-care*; (4) ***R****ed flags*; and (5) ***c****omplete* ***T****reatment*, from which we generated the mnemonic acronym "InFARcT." Defining and structuring the content of discharge information seems especially important for ED physicians and patients, as stress and time constraints jeopardize effective communication in this context.

Discharge Communication in Patients Presenting to the Emergency Department with Chest Pain: Defining the Ideal Content

Chest pain accounts for up to 10% of all patient presentations in emergency departments (EDs) (Konkelberg & Esterman, 2003). The majority of these patients will usually be discharged within hours, after exclusion of serious conditions such as myocardial infarction (Goodacre et al., 2011). A comprehensive work-up of low- to intermediate-risk patients is not feasible in the ED (Reichlin et al., 2009). Yet many of these patients go on to suffer from repeated episodes of chest pain, associated with anxiety and uncertainty about diagnosis and outcome (Jones & Mountain, 2009). Effective discharge communication, empowering patients to understand and memorize medical information, should therefore be an integral part of patient care. It is a likely contributor to better outcomes (Bishop, Barlow, Hartley, & William, 1997; Kessels, 2003), higher patient satisfaction (Kessels, 2003), better adherence to medication (Cameron, 1996; Kessels, 2003), more adequate disease management, and reduced anxiety (Galloway et al., 1997; Mossman, Boudioni, & Slevin, 1999).

Communication Challenges in the Emergency Department

Communication between physician and patient represents a fundamental element of healthcare quality, and is attracting an increasing amount of attention in healthcare studies (Ong, de Haes, Hoos, & Lammes, 1995). Physician-patient communication about prognosis and preferences for care is critical in helping patients adequately prepare for and plan future care, and physicians' communication style may affect patients' satisfaction, trust, willingness to cooperate, and health status (Ambady, Koo, Rosenthal, & Winograd, 2002; Beck, Daughtridge, & Sloane, 2002; Fiscella et al., 2004; Hall, Roter, & Katz, 1988). Investigating the communication between physicians and patients can therefore help to optimize healthcare provision by identifying specific training needs for physicians in this context.

Physicians working in the ED face numerous challenges, such as working in a chaotic environment and treating mentally or chronically ill patients, that impact ED communication,

which is also constrained by stress and the time-sensitive nature of many cases (Dean & Oetzel, 2014). Patients arrive in the ED with various amounts of information, experience with the healthcare system, language fluency, and health literacy (Samuels-Kalow, Stack, & Porter, 2012), and the practice of emergency medicine is characterized by episodic contact with patients and difficulties in establishing continuous care.

For many patients, being discharged from the ED represents a moment of high vulnerability (Samuels-Kalow et al., 2012). Ineffective communication at discharge may result in adverse consequences, ranging from inappropriate use of drugs to neglect of follow-ups for pending tests. Effective discharge communication is an important tool for establishing continuity of care and a link to the primary care provider (Kripalani et al., 2007; Samuels-Kalow et al., 2012; Villanueva, 2010). Furthermore, it is likely to be cost-effective by reducing readmission of patients with ischemic heart disease (Menzin, Wygant, Hauch, Jackel, & Friedman, 2008).

Rationale for This Research

Notwithstanding these potential benefits, little is known about ED patients' understanding of their condition, or their ability to memorize and recall information and instructions following discharge (Sanderson, Thompson, Brown, Tucker, & Bittner, 2009). For patients with chest pain, ED discharge represents an important transition to primary care or cardiology; for physicians, it is an important opportunity to proactively address patient-specific issues (Villanueva, 2010). A recent study, however, showed that chest pain patients were often unable to recall diagnoses or advice after discharge; furthermore, they reported limited opportunity to discuss their diagnosis, their worries, and their questions on further management (Price et al., 2005). Ineffective discharge communication does not appear to be the exception to the rule. Immune-compromised patients' knowledge of medication at discharge was also found to be only moderate (Chau et al., 2011).

There are various ways to render discharge communication more effective, such as using tools (Jones & Mountain, 2009), improving communication skills (Langewitz, Eich, Kiss, & Wossmer, 1998), and defining the ideal content, which has rarely been attempted. In EDs in Switzerland and most European countries, verbal discharge communication without written instructions is the standard of care. Yet a recent study showed that verbal ED discharge instructions are often incomplete (Vashi & Rhodes, 2010). Note, however, the nine categories examined in the Vashi and Rhodes study were derived from a textbook rather than based on physicians' or patients' opinions or objective criteria. Patients' needs, as assessed in a chest pain clinic, suggest that patients want to be reassured; they want to know what caused their pain, to understand the cause, and to feel able to help themselves (Price et al., 2005). Price and colleagues proposed that patients should be provided with written information regarding the diagnosis, future medical care, self-care, and health promotion. Although researchers have also begun to assess patients' information needs in psychiatry (van Os & Triffaux, 2008) and oncology (Buzaglo et al., 2007), no such research has been conducted in the context of emergency medicine. And, to our knowledge, however, no previous study has assessed both physicians' and patients' informational preferences in ED discharge communication, and the extent to which both parties' preferences converge.

Goals of This Investigation

In this study, we addressed the following research question: What are the similarities and differences of the communication preferences between physicians of different specialties and patients suffering from chest pain? Specifically, we aimed at investigating and improving physician-patient communication in an ED discharge setting by identifying the information that needs to be covered in this interaction. As successful communication involves both parties, the sender (physician) and the receiver (patient), we examined both patients' and physicians' views of the ideal content of a discharge communication. Although we are aware

that the form of physician-patient communication is just as important as the content and that the two are, in practice, inseparable, our focus in the present study was to identify the ideal content of effective discharge communication with ED patients presenting with acute chest pain. This content was determined from physicians' and patients' evaluations of what information should be conveyed. Another goal was to assess the extent of agreement between physicians and patients. Finally, we aimed to generate a mnemonic tool helping physicians and patients to remember key information. To this end, we synthesized the derived information into the smallest number of discrete categories capturing all elements that the physicians and patients considered important. These categories of items were then grouped such that physicians and patients could take advantage of "chunking," a powerful mechanism to boost learning and human memory (Chen & Cowan, 2005; Gobet et al., 2001; Li et al., 2013). Specifically, we generated an acronym from the first letter(s) of each category. The letters of the acronym serve as retrieval cues to items that need to be remembered. For instance, the acronym HOMES helps to remember the Great Lakes: Huron, Ontario, Michigan, Erie and Superior.

Methods

Study Design

The single-center cross-sectional study comprised two phases: First, we quantitatively assessed physicians' views of the ideal content of an ED discharge communication for patients presenting with acute chest pain. Second, we assessed patients' evaluations of this content, both quantitatively and qualitatively. Our study thus implemented a mixed methods approach incorporating elements derived from both quantitative and qualitative traditions: (1) A comprehensive list of items that could potentially be discussed at discharge were evaluated by both patients and physicians in paper-and-pencil format. (2) Face-to-face interviews (free generation task) were conducted with ED patients presenting with chest pain, and the transcripts were subjected to qualitative analysis. The mixed methods approach has proved valuable in various healthcare communication studies (Arora et al., 2010; Bennett, Switzer, Aguirre, Evans, & Barg, 2006; Cherlin et al., 2005; van Staa, 2011; Wittink, Barg, & Gallo, 2006). Mixed methods research has the potential to collect, analyze, and combine both quantitative and qualitative data in a single study. We used a mixed methods design as it accommodates key aims of this study: (1) To determine, through quantitative methods, the ideal content of ED discharge communication with chest pain patients from both the senders' and the receivers' perspective, and to formalize a comparison between these, and (2) to elicit, through qualitative methods, patients' perspectives on the information required at discharge. Physicians (cardiologists, internists, and ED physicians; $N = 47$) and chest pain patients awaiting ED discharge ($N = 51$) were the main sources of information.

Setting

The study was conducted at the ED of the University Hospital of Basel, an urban 700-bed tertiary care teaching center. The University Hospital of Basel is one of Switzerland's five university medical centers, consisting of 52 departments and institutes with interdisciplinarity as a strategic aim. It serves a population of 500,000, and more than 45,000 trauma and

nontrauma patients are seen in the ED every year. Specialists of all disciplines and subspecialties are available around the clock. The local ethics committee approved the study protocol (http://www.clinicaltrials.gov ID NCT01540266). Patients and physicians gave written informed consent.

Phase One: Physicians

Participants. Recruitment took place during three staff meetings in the departments of cardiology, internal medicine, and emergency medicine. All 47 physicians present during meetings volunteered to participate.

Procedures and Data Collection. Physicians were fully informed about the study's goal: To determine the ideal content of effective discharge communication with chest pain patients. Responses were collected during staff meetings and subsequently anonymized. Specifically, physicians were presented with a list of 81 items (Ackermann et al., 2012) that could potentially be addressed at discharge. This initial list was constructed by three of the authors (physicians with over 10 years of experience), taking advantage of their first-hand knowledge of discharge communication. Participating physicians first read an original patient history[1]. They then selected the items they felt needed to be addressed in a (typical) discharge interaction of less than 15 minutes (items were not ranked). The standardized instruction read as follows: "You are the responsible physician and plan a discharge interaction lasting less than 15 minutes with the patient described above. From your point of view, which of the points listed below should be discussed?"

For each physician, the following information was recorded: age, sex, position, specialty, experience in the specialty (in years), and overall clinical experience (in years). A randomly selected subset of 12 physicians was asked to repeat the assessment, on average 6 months after the first assessment, without being prospectively informed about this retest. The retest data were used to determine intra-rater reliability.

[1] Complete original patient history is available from the corresponding author

Phase Two: Patients

Participants. Recruitment took place from May 2012 to October 2012 in the ED of the University Hospital of Basel on weekdays during the day shift and was conducted by a psychologist. The electronic patient tracking system was screened to identify those patients with chest pain who had completed clinical work-up and were awaiting discharge from the ED. Exclusion criteria were chosen to limit participation to patients with an intermediate risk of coronary heart disease (CHD). Specifically, patients meeting one or more of the following conditions were excluded:

- High-risk features in an ECG (e.g., ST elevation) and/or increased high-sensitive troponin levels (to exclude high-risk patients),
- none of the following cardiovascular risk factors: smoking history, diabetes, hypertension, dyslipidemia, age above 50 years, family history of CHD (to exclude low-risk patients),
- dementia, as defined by a score of < 7 on a clock-drawing test,
- age under 18 years,
- limited German language skills (German being the default language at the hospital).

Procedures and Data Collection. Study enrollment was conducted shortly before the discharge communication. Chest pain patients were presented with a text informing them about the study's goal and procedure: to determine the ideal content of effective discharge communication with chest pain patients. After giving their written informed consent, patients responded to demographic questions (age, sex, profession, race, and nationality). Their emergency severity index (ESI) was recorded (Gilboy, Tanabe, & Travers, 2005). One of the authors (psychologist) conducted all face-to-face interviews (free generation task), in which patients were asked for their thoughts on the information to be provided at discharge. Specifically, patients were asked the following open-ended question: "With respect to the upcoming discharge interaction with your attending physician: What kind of information is important to you?" If patients' statements were irrelevant, we tried to guide them by briefly

repeating the question. Subsequently, the patients were presented with a list of the 34 items endorsed by the majority of study physicians (see Results section). Some items were rephrased in lay terms to make them comprehensible (based on the results of a pre-study with 30 ED patients who evaluated the comprehensibility of each item; items not understood by more than 20% of patients were rephrased until comprehensible). For each item, patients stated whether they would prefer it to be included in or excluded from a discharge interaction, whether they had no preference, or whether they found the item incomprehensible. We collapsed the categories "excluded" and "no preference," treating both as "undesired." Only 39 of the 1734 responses evaluated an item to be "incomprehensible," and they were reasonably evenly spread across all 34 items. We therefore treated these responses as "missing," and did not have to exclude any items (only the items concerning beta blockers and nitroglycerine were incomprehensible to a greater amount of patients (i.e. 10 and 9 patients, respectively), but as most patients who understood them considered them crucial, they were also not excluded). All responses were rendered anonymously. Finally, 6 days after baseline assessment, retest materials were mailed to all patients' homes in order to assess the reproducibility of our approach.

Consensus Classification System

Having used physicians' and patients' answers to define the ideal content of an effective discharge communication (34 items), we sought to group these items into the smallest possible number of discrete informational categories. To this end, we identified three expert physicians with more than 12 years' experience in the field and a position that involved student teaching and training of junior physicians. These experts discussed the items and potential categories, and reviewed the results in several rounds until five categories emerged (see below for results).

Data Analysis

Descriptive statistics (means, standard deviations) and analyses were calculated with SPSS for Windows (v. 18). Patients' answers to the free generation task were audiotaped, transcribed verbatim, and coded. After the three experts had achieved consensus on the five categories of information, two independent raters (an ED physician and a psychologist) coded each transcript by mapping patients' answers to the categories of the consensus classification system (see below). In case of disagreement, consensus was reached through joint analysis and discussion of the audiotapes and the transcripts. An inter-rater reliability analysis using Kappa statistics was performed to determine consistency among raters (Landis & Koch, 1977). The ten most frequently named patients' informational needs that could not be assigned to the classification system were then noted. Because this method is not empirically derived, it is only a best approximation for evaluating the audiotaped responses. Correlations between the percentages of physicians and patients who endorsed the respective items as well as between physicians' and patients' initial and retest scores were calculated using Pearson's correlation coefficient. Concordance between the two distributions of the items was calculated using Mann–Whitney U test.

Results

Participant Characteristics

Physicians. Among the 47 participating physicians (19 women), there were 6 interns, 11 residents, 25 consultants, 4 senior consultants, and 1 department head. The average clinical experience was 10.1 years (SD = 8.3). In terms of specialty, 23 were hospital internists, 13 emergency physicians, 8 cardiologists, 2 preclinical emergency physicians, and 1 internist specialized in psychosomatic medicine.

Patients. A total of 187 patients were consecutively screened for inclusion. Of those, 4 were excluded because of dementia; 2 because they were aged under 18; 67 because of increased troponin levels or high risk features in the ECG; 7 because of lack of cardiovascular risk factors; and 33 because of limited language skills. Finally, 23 patients were excluded for miscellaneous other reasons (mostly no informed consent). A final sample of 51 patients resulted.

The mean (SD) age of the 51 patients (22 women) was 53.8 (16.7) years, with a range of 21 to 83 years. All patients presented to the ED because of chest pain, and data were obtained in the ED (41 patients) or the ED-associated monitoring and decision unit (10 patients). A total of 35 (69%) patients had an ESI level of 2; 16 (31%) had an ESI level of 3. The majority (63%) were Swiss; the rest had various other nationalities (Portuguese, Spanish, German, Sri Lankan, Turkish, Italian, and Serbian), a mix typical for Swiss urban EDs.

Consensus Between Patients and Physicians

Physicians were first presented with the full list of 81 items. The 34 items with > 50% physician endorsement were then presented to the patients. Table 1 lists these 34 items and the proportions of physicians and patients endorsing them. All but two of the 34 items endorsed by the majority of physicians were also judged to be important by more than 50% of patients (i.e., 32 of the 34 items); 26 were endorsed by more than 75% of patients. One item was endorsed by less than 50% of all patients (“address the need to stop smoking”; however,

this item was selected by 59% of patients with present or past smoking history). Finally, one item was endorsed by exactly 50% of patients ("Encourage the patient to make an appointment with his family physician to obtain more information"), but by about two-thirds of physicians.

Application of the Consensus Classification System

Given the high concordance between physician and patient perspectives, we used the condensed list of 34 items to generate categories. Working individually, three expert physicians identified a small number of non-overlapping basic categories to which the individual items could be assigned and classified each item to those categories. Each individual classification system was then shared and discussed with the others, with the goal of arriving at a system agreed upon by all participants. The resulting classification system comprises five categories (Table 1): Seven items were assigned to the category "Information on diagnosis," nine to the category "Follow-up suggestions," four to the category "Advice on self-care," six to the category "Red flags," and eight to the category "Complete treatment."

Two independent raters also used the consensus classification to categorize patients' freely generated answers; inter-rater reliability was fairly high (Kappa = 0.70 [$p < 0.01$], 95% CI [0.61–0.79]). All disagreements between the two independent raters could be resolved by discussion, consulting the other authors as experts.

The correlation between the percentage of items endorsed by patients and that endorsed by physicians proved to be essentially nil ($r = 0.013$; $p = 0.94$). Yet concordance between patients and physicians was high, with 32 of the 34 items selected by the majority of physicians also being selected by the majority of patients. A Mann–Whitney U test demonstrated that the two distributions did not differ significantly from each other ($U = 544$, $p = 0.15$).

Patients' Needs as Elicited by the Free Generation Task

Patients' responses in the free generation task showed greater variation across the categories of the consensus classification system. A total of 84% of patients voiced a need to receive information on their diagnosis, 22% on their follow-up, 55% on self-care, 20% on red flags, and 14% on their complete treatment. Numerous statements could not be assigned to the categories of the classification system. Table 2 lists patients' 10 most frequently named needs as derived from the free generation task. All of these items concerned the style or form, but not the content, of the discharge communication. As the focus of this study was on defining the ideal content of discharge communication, they were not appended to the condensed list of items.

Generation of a Mnemonic Acronym

Using the initial letter(s) from the classification categories, we generated the acronym "InFARcT" (In: **In**formation on diagnosis; F: **F**ollow-up suggestions; A: **A**dvice on self-care; R: **R**ed flags; cT: **c**omplete **T**reatment). This acronym is not a neologism but represents a word with an established meaning both in the medical nomenclature and (in German-speaking countries) in everyday discourse. It is obviously also highly pertinent to patients with acute chest pain.

Retest Results

A randomly selected subset of 12 physicians participated in the retest. Of the 51 patients contacted, 31 completed the retest materials (on average, 17 days after the initial assessment). In order to determine how reliable both physicians' and patients' responses were, we correlated their first and second selections. Correlations proved to be moderate (physicians: $r = .52$, $p < .001$, in the full set of 81 items; patients: $r = .53$, $p < .001$, in the condensed set of 34 items). However, we were still able to assign all items endorsed by physicians in the retest to the classification system we had developed based on their initial answers. Thus, all categories "survived" this retest.

Discussion

How can the content of discharge communication in the ED be designed to optimize patient outcomes? To our knowledge, there has been scarce systematic study of this issue. Although chest pain, relative to other symptoms, is a well-defined and well-recognized symptom in the general population (Mata, Frank, & Gigerenzer, 2012), a multitude of information could, in theory, be conveyed to a chest pain patient who is being discharged. At the same time, there are severe limitations on physicians' time and, equally importantly, the human capacity to recall information. Physicians tend to overestimate patients' capacity to recall information while simultaneously underestimating the time needed to convey information (Ackermann et al., 2012). Taken together, efforts to define the both the scope and the content of discharge communication are anything but trivial.

Our goal was to implement a new method for content definition, using the example of chest pain, one of the most frequent complaints in the ED. Using an iterative procedure involving both "expert" groups (i.e., physicians and patients) and a group of expert physicians, we generated and refined a list of important items to be discussed at discharge. By involving professionals with daily experience of chest pain patients (i.e., cardiologists, internists, and emergency physicians), we sought to bring medical expertise and a focus on feasibility to the process; by involving patients, we sought to represent the perspectives and needs of people experiencing alarming symptoms.

Our key finding is that the two "expert" groups strongly overlap in their assessment of what ought to be conveyed in discharge communication: Nearly all items identified by the majority of physicians as important were also endorsed by the majority of patients. Specifically, about four in five of the items endorsed by the majority of physicians were rated as important by more than 75% of patients. This strong consensus provides one basis on which the content of discharge communication can be defined.

However, some disparities remained (see Table 1). Take, for instance, the issue of addressing risk factors (see Advice on self-care). This is an aspect that a large majority of patients (94%) considered important, relative to just over half of the physicians (53%). Relatedly, 100% of patients felt it important to be told that their blood, heart, and lungs had been thoroughly examined, relative to just 56% of physicians. There are several possible explanations for these disparities: First, one could speculate that these and other disagreements may be due to physicians—cognizant of time constraints, but not fully aware of patients' need for reassurance—omitting to state things they consider obvious ("thorough examinations"). Second, another hypothesis is that these disparities could reflect different ideas as to how much people can encode and process in a given period of time. Indeed, patients and physicians greatly overestimate the number of items that can be communicated within the prescribed 15 minutes—and that human memory is likely to be able to store. Third, patients may come to the ED with only fragmentary knowledge of the topic of the discharge communication, as has been shown for stroke patients (Williams, Bruno, Rouch, & Marriott, 1997). Physicians should therefore ascertain the degree of patient understanding in this area. Finally, patients were asked to rate their own informational needs, whereas physicians were rating the needs of patients in general. Thus, caution is warranted in over-interpreting the total difference in informational needs between patients and physicians.

Three expert physicians classified the items chosen by the two groups into five exclusive categories. These categories are similar to the seven categories used in a recent study on written discharge communication (Vashi & Rhodes, 2010); however, the latter study gave no principled account for the choice of the categories. The same holds for another recent study using written discharge information (Arnold, Goodacre, Bath, & Price, 2009). Again, four of five of their categories were identical with our classification system. This study concluded that written discharge information can reduce anxiety and depression, improve mental health and perception of general health, but does not influence satisfaction with care or

other outcomes (Arnold et al., 2009). More generally, a recent systematic review on the role and effectiveness of written discharge information found no robust evidence that it affected patient satisfaction or adherence (Raynor et al., 2007). Even if written information were the key to higher patient satisfaction and better health outcomes in patients with chest pain, physicians need help to decide which content has the potential to improve patient outcomes. In the absence of any longitudinal studies, one way to determine the ideal content of written communication is by consulting the two parties involved, as we did for verbal communication. And even if written discharge information is the standard of care, a normal ED discharge will conclude with verbal communication. Physicians should not waste this opportunity to communicate and to educate.

A review study (Stewart, 1995) found a correlation between effective physician–patient communication and improved patient outcomes, with a multitude of interventions and instructions emerging to be beneficial. However, all of the analyses reviewed assessed the form of the physician–patient interaction; none assessed the content (though, as Table 2 shows, the mode of communication is also of utmost importance). Structuring the content of ED discharge communication and offering a mnemonic aid could improve patients' outcomes. For instance, parents of children with otitis media who received standardized discharge instructions were better able to recall information than were parents who received non-standardized instructions (Isaacman, Purvis, Gyuro, Anderson, & Smith, 1992). By the same token, a standardized approach to physician–physician interaction using the DINAMO acronym led to a significant decline in missing or wrong information detected after handover (Rudiger-Sturchler, Keller, & Bingisser, 2010). Notwithstanding these findings, further research is needed to define the ideal quantity, quality, and form (e.g., written vs. oral) of discharge information. Such outcome studies can include a wide range of measures, ranging from short-term patient satisfaction and reduction of anxiety to morbidity and use of health-care resources.

Limitations and Future Directions

Our results suggest that the content of discharge information for patients presenting to the ED with chest pain can be standardized based on physicians' perspectives and patients' expressed informational needs. For several reasons, physicians and patients are unlikely to be in complete agreement as regards the ideal content. First, there is substantial inter-individual variation. As we have previously shown, physicians selected between as few as 20 and as many as 57 items (Ackermann et al., 2012). Second, there is substantial intra-individual variability, as can be inferred from the moderate level of reliability in both physicians' and patients' retests. Nevertheless, it seems that even if there is not necessarily agreement on individual items, there is broad agreement on categories.

Another limitation of our study is that standardization cannot replace individualized communication. A protocol should never compete with or even replace patients' questions. Fears must be perceived, addressed, and discussed. We are well aware that good discharge communication requires tools and communication skills such as mirroring and permitting patients to speak for longer than a few seconds without interruption (Suchman, Markakis, Beckman, & Frankel, 1997). However, this study focused on the content of discharge communication, rather than on such skills.

Finally, a gold standard for defining effective content is currently lacking; only few outcome studies (Engel et al., 2012; Isaacman et al., 1992) have investigated the effect of discharge information on outcomes such as patients' ability to recall information, morbidity, or quality of life after discharge, and none have focused on one of the most frequent serious complaints in patients presenting to EDs, namely chest pain. A first necessary step toward such studies is to define the substance of an effective discharge interview. Our study represents an attempt to offer such a definition.

Our results indicate that two avenues of future research can help achieve deeper insights into the mechanisms involved in physician-patient communication. First, extensive

work is needed in the field of patient recall. Given the high number of items selected as important by both patients and physicians, how and to what extent could patients' memory for the information discussed during discharge be maximized? Investigations of whether well-established mnemonic techniques, such as the method of loci (Bower, 1970) or the testing effect (Roediger & Karpicke, 2006), could enhance patients' ability to recall instructions are warranted.

Second, research efforts should be directed at devising and evaluating strategies to help physicians implement the content elaborated in this study in real discharge communication and assessing its impact on outcomes such as patient satisfaction, stress, and acquisition of disease-related information. Efforts are needed to determine whether structuring communication along these lines affects patient recall. Furthermore, studies assessing the effects of various forms of physician communication on patient outcomes and combining elements of both content and form are highly warranted.

Practical Implications and Conclusion

One way of addressing the thorny issue of recall is to offer both parties involved in a communication a mnemonic device. The content of this communication should consist of categories and items that are limited in number, easy to retrieve (for both physicians and patients), and conducive to grouping into high-level, meaningful categories. Chunking increases the likelihood that people can reproduce the information they have received (Gobet et al., 2001; Li et al., 2013). Presenting discharge information in combination with the categories and thus in clustered form has the potential to foster patients' ability to reproduce it later. To what extent this is indeed the case should be addressed in future work.

Defining and structuring the content of discharge information for the most frequent diagnoses seems especially important for ED physicians. In the ED, stress and time constraints jeopardize optimal communication. Furthermore, the vast majority of residents in this field cannot call upon extensive experience, especially in countries in which emergency

medicine has not yet become a specialty. Effective communication, in content and form, at the moment of discharge represents a valuable and rare opportunity to communicate, and thereby to foster better outcomes. It should not go to waste.

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Table 1

Endorsement of the 34 Items, Classified to the Five Categories, by Physicians and Patients, Respectively

Category	Item	Physicians (N = 47)	Patients (N = 51)
Information	Inform the patient that he is ready to go home	89%	96% (48/50)
on diagnosis	Reassure the patient ("you were right to come to the ED")	72%	73% (37/51)
(7 items)	Explaining that blood, heart, and lungs were thoroughly examined	57%	100% (51/51)
	State the presumptive diagnosis	83%	98% (49/50)
	Broad statement: "All the investigations exclude a diagnosis of myocardial infarction at this time"	79%	94% (48/51)
	Explain the significance of the presumptive diagnosis	66%	96% (48/50)
	Explain the association of symptoms with the suspected diagnosis	62%	96% (49/51)
Follow-up	State why further investigation is necessary	94%	92% (47/51)
suggestions	State what the planned investigations are	89%	75% (38/51)
(9 items)	State when the investigations will be carried out	77%	88% (45/51)
	State where the investigations will be done	74%	82% (42/51)
	Describe necessary precautions for the test (no coffee, no tea, …)	64%	88% (45/51)
	Explain that an information sheet with details of the pretest preparation will be sent by post	57%	65% (33/51)
	Explain that detailed information on the time and location of the test will be sent by post	68%	78% (39/50)
	Advise the patient to contact his family physician should he have further questions	79%	65% (33/51)
	Encourage the patient to make an appointment with his family physician to obtain more information	68%	50% (25/50)

Advice on self-care (4 items)	Address risk factors	53%	94% (48/51)
	Address the need to stop smoking	83%	48% (24/50)
	Address current avoidance of physical stress	81%	78% (39/50)
	Recommend that the patient resumes normal daily activities	53%	90% (46/51)
Red flags (6 items)	Stress that the patient should present immediately to the ED in case of chest pain radiating into arms/jaws	83%	94% (48/51)
	Stress that the patient should present immediately to the ED if the symptoms last longer than 10 minutes	81%	86% (44/51)
	Stress that the patient should present immediately to the ED if he is dyspnoeic	68%	92% (46/50)
	Stress that the patient should present immediately to the ED if he experiences chest pain not responding to nitroglycerine	96%	88% (43/49)
	Explain that the ED is open 24/7 (“you may come back any time”)	68%	63% (32/51)
	Reassert the importance of presenting immediately to the ED in case of any complaints or symptoms, even at night	57%	53% (27/51)
Complete treatment (all medication) (8 items)	Explain that treatment has to start immediately	55%	90% (46/51)
	Explain why treatment has to start immediately	70%	86% (44/51)
	State the names of the new medications (ASS, beta blocker, nitroglycerine spray)	96%	76% (39/51)
	Give the ASS dose and explain when it should be taken	66%	84% (42/50)
	Give the beta blocker dose and explain when it should be taken	64%	88% (36/41)
	Describe the side effects of beta blockers	53%	85% (39/46)
	Give the nitroglycerine dose and explain when it should be taken	81%	86% (36/42)
	Describe the side effects of nitroglycerine	62%	89% (42/47)

Note.

Percentages indicate the proportion of physicians and patients, respectively, who selected each item.

In brackets: Number of patients selecting the item/number of patients comprehending the item.

Table 2

The 10 Most Frequently Named Patient Needs as Elicited by the Free Generation Task

Patients wish…
to feel cared for
to be reassured
to be taken seriously
to have the opportunity to ask questions
to have their questions answered
to be able to spend sufficient time with the physician
for the physician to do their best
for the physician to use appropriate language
for the physician to admit if they do not know something
for the physician to be completely honest without concealing details

Title: Improving patient recall of information: Harnessing the power of structure

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Keywords: patient information; information recall; improving recall; structuring information; book metaphor

Abstract

Objective: Assess the amount of medical information laypeople recall, investigate the impact of structured presentation on recall.

Methods: 105 first-year psychology students (mean age 21.5 ± 3.8 years; 85% female) were randomised to two information-presentation conditions: structured (S group) and nonstructured (NS group). Students watched a video of a physician discharging a patient from the emergency department. In the S Group, content (28 items of information) was divided into explicit "chapters" with "chapter headings" preceding new information. Afterwards, participants wrote down all information they recalled on an empty sheet of paper.

Results: The S group (N = 57) recalled significantly more items than NS group (N = 41) (8.12 ± 4.31 vs. 5.71 ± 3.73; p = 0.005), rated information as easier to understand (8.0 ± 1.9 vs. 6.1 ± 2.2; p < 0.001) and better structured (8.5 ± 1.5 vs. 5.5 ± 2.7; p < 0.001); they rather recommended the physician to friends (7.1 ± 2.7 vs. 5.8 ± 2.6; p < 0.01).

Conclusion: University students recalled around 7/28 items of information presented. Explicit structure improved recall.

Practice implications: Practitioners MUST reduce the amount of information conveyed AND structure information TO improve recall.

Improving patient recall of information: Harnessing the power of structure

1. Introduction

Communication in health care often means the exchange of medical information. This is true for ward rounds in internal medicine [1], outpatients in internal medicine [2], and oncological consultations [e.g. 3, 4]. Findings indicate that many patients and their relatives want to be fully informed about their condition [5-8]. For instance, questionnaire data indicate that 87% of patients "want to be told all information" and only 9% "want the doctor to choose how much information to give" [9] [see also 5, 6]. Similarly, QUALITATIVE DATA SHOW THAT both patients and parents expect physicians to inform them about diagnosis, therapy, and prognosis [10-12].

Patient–physician communication goes beyond the filling of knowledge gaps, however. It is also the basis for patients' inferences about the health practitioner. For instance, recent qualitative studies on communication in oncology have demonstrated that patients' *trust* is based primarily on the impression of clinical competence that emerges from their communication with oncological surgeons and haematologists [13]. Furthermore, Parker et al. [14] and Hagerty et al. [15] have reported that patients' *hope* depends largely on the impression that their physician is competent and "knows all there is to know about the disease". Physicians may not be aware of the importance that patients attribute to receiving information, however: In their studies of patient centeredness and consultation skills in primary care, Ogden et al. [7] and Robinson et al. [8] found that patients ranked items relating to patient information and the structure of consultations significantly higher than physicians did.

However, other findings suggest that the exchange of information may be an ephemeral phenomenon. Specifically, several studies have found that patient comprehension and recall of information is limited [16, 17]. Three examples from surgery illustrate these limitations: On average, only 2 out of 5 complications were recalled in the context of elective plastic surgery [18]; 5 out of 32 pieces of information were correctly remembered two hours after the preoperative discussion prior to brain surgery and 4 out of 25 pieces of information prior to spinal surgery [19] (for a recent review, see [20]). Questionnaire data from patients with advanced metastatic cancer revealed how little patients understood of their clinical situation. Although they had been informed by their doctors about the advanced stage of their disease and the clinical consequences, they largely overestimated the chance of recovery and failed to understand the palliative rather than curative goal of their treatment [21].

These insights raise the following questions: How can patient recall and understanding of medical information be improved? One of the first authors to address these questions was Philip Ley (e.g. [22]). Ley recommended using explicit categorisation, with the clinician presenting "information

in categories, which he has announced in advance". Several review articles have since investigated whether patient understanding and recall of information can be improved by the use of additional communicative aids. Although results have been mixed and the evidence is not always convincing, the general picture to emerge is that patients recall slightly more information when they are given written or otherwise DESIGNED information material. For example, Ciciriello et al. [23] found weak evidence that the addition of multimedia material to standard instructions improved patient knowledge about medication (see also [24-26]). To our knowledge, however, none of the interventions evaluated in these review articles have focused on the explicit structuring of verbal information.

Although the provision of generic written information improves patient knowledge to some extent, it is associated with two major problems: First, information leaflets on diagnostic interventions usually cover the standard procedure in common diagnoses. However, the typical patient presents with a more complex combination of symptoms, diagnoses, and treatment options—a complexity that cannot be accommodated in standardised materials. Second, even when provided with the most sophisticated information material, patients show much lower recall capacity than physicians evidently assume: Physicians asked which information was essential for patients discharged from the emergency department after presenting with acute chest pain on average chose 36 out of 81 pre-defined items [27]—far beyond the typical recall capacity reported in the literature [E.G. 20]. Both problems are related. Tailoring information to more complex real-world cases is likely to involve the provision of even more information.

In principle, there are two ways out of this dilemma: less information or better communication. By better communication, we mean communication in ways that increase the likelihood that patients will later be able to retrieve the information. Here, we investigate whether structuring medical information improves recall. Specifically, information appears easier to retain when it is structured in a way that helps the recipient to organise it [28, 29]. In written material, structure is reflected in the way content is ordered sequentially. For instance, in newspapers, headlines precede the main text and are easy to identify; they announce the topic elaborated on in the text. Books use even more sophisticated structural elements to guide readers through content: title, table of contents, chapter headings, text, reference list, etc. In our communication skills training for medical students, we have used the term "book metaphor" to help participants understand, appreciate and remember the value and function of "structuring information" [30, 31].

In this pilot study, we investigated whether first-year psychology students serving as surrogate patients recalled more information when discharge information was presented in structured form, in accordance with the book metaphor, than they did when exactly the same information was presented in nonstructured form.

2. Methods

2.1 Participants

First-year psychology students were invited to participate in a trial measuring recall of medical information. Of the 167 students approached, 105 agreed to participate and provided informed consent. Sixteen of these students were male; mean age was 21.5 ± 3.8 years. Ninety-eight students returned completed recall protocols. The study was approved by the local ethics committee (protocol number: 362/11). Participants received no compensation for their participation.

2.2 Study design

On their arrival, students were randomly allocated to two lecture halls. They were informed that they were participating in an experiment about physicians' communication style, and that they would be shown a video of a physician discharging a patient from the emergency department. The patient was a white man of around 75 years of age, played by an actor. The information conveyed was defined after a careful Delphi process, in which three expert physicians agreed on 28 items of information that they considered essential for a patient with unstable angina pectoris after exclusion of acute myocardial infarction [32]. The experts were informed that this information would be given to a patient during discharge from the emergency department, that the time allotted for this consultation was a maximum of 15 minutes, and that the patient would see his GP within the next two or three days. Study authors reviewed the two versions of the video to make sure that both contained the same factual information.

The two student groups watched the same male physician deliver exactly the same 28 items of information in a friendly manner and without the use of medical jargon in either structured or nonstructured form. Specifically, in the nonstructured condition (NS group), the order of presentation was based on traditional clinical wisdom: pieces of information that belonged together because they pertained to, for example, the likely diagnosis of coronary artery disease were presented in one block of information (likewise, there were blocks of information on pathophysiology, further work-up, therapy, and red flags). However, there was no *explicit* structure. In the structured condition (S group) the information presented was structured following the structural elements of a book, in which the content is presented in a specific order, typically advancing from summary, high-level information (e.g., title, table of contents, chapter headings) to detailed, low-level information (e.g., text, annexes). Following this book structure [33], the physician initiated the interaction as follows:

Mr. Lehmann, I will now give you some *discharge information* (TITLE).
Before you go home, there are five points that I would like to inform you about (TABLE OF CONTENTS)
First: What is your diagnosis?
Second: What will happen next?
Third: What can you do yourself?
Fourth: What do you have to pay attention to in order to be on the safe side?
Finally, the fifth and last point: What will the treatment look like?
Let me start with the first point: What is your diagnosis (1st CHAPTER HEADING):
The good news is that you don't have a myocardial infarction ….. (TEXT).

2.3 Dependent variables

Immediately after watching the video (and without prior warning), students were given 5 minutes to write down all the information they remembered from the exchange. They were asked not to consult their neighbours. No further instructions were given. Students were then asked to complete a questionnaire assessing their prior medical knowledge. This multiple-choice questionnaire covered the following topics: definition of myocardial infarction; definition of angina pectoris; risk factors for cardiovascular disease; typical pain sensations in myocardial infarction; cardiac angiography; physiological processes typically associated with cardiac pain. They then rated their current sense of well-being (numerical rating scale from 0 [*very bad*] to 10 [*very good*]), their ability to concentrate on the day of the study (numerical rating scale from 0 [*very low*] to 10 [*very high*]), and their perception of the physician on three items ranging from 0 to 10, with 0 representing a low or negative response and 10 representing a high or positive response.

Students' recall performance (i.e., the number of items of information recalled) was assessed by two independent raters, one of whom rated all of the protocols and the other, 10% of them. Analyses of the agreement between the two raters resulted in a Cohen's kappa of 0.74, indicating substantial interrater reliability according to Landis and Koch [34]. When it became clear that some students in the structured condition had also noted down chapter headings, we also assessed the extent to which students recalled these structuring elements. Both raters independently screened all protocols to identify the five chapter headings listed in the example above. They agreed fully on the number of protocols in which at least one chapter heading was recalled and differed in the number of chapter headings recalled in only 2 of those 33 cases. Agreement was achieved by discussing these differences.

2.4 Statistical analysis

All data were analysed with SPSS. Items recall is presented in terms of the percentage of students who noted down each item in the recall protocol. We report means and standard deviations for students' subjective well-being, concentration ability, and perceptions of the physician in the two conditions; comparisons between groups were conducted using *t*-tests for independent samples. The influence of prior medical knowledge, subjective well-being, and concentration ability on recall was assessed by an analysis of covariance (ANCOVA), with number of recalled items as the dependent variable and condition as the independent variable.

3. Results

One student in the nonstructured and 6 students in the structured condition returned empty recall protocols. Students in both groups reported a similar sense of well-being on the day of the study (6.5 ± 1.8 in both groups; n.s.). Students in the structured group felt better able to concentrate (6.5 ± 1.8 vs. 5.6 ± 2.0; p=0.03). Students in the structured group answered 3.20 ± 1.3 items correctly in the medical knowledge assessment, slightly but not significantly more than their counterparts in the nonstructured group (2.94 ± 1.08 items, n.s.).

Table 1 presents both groups' perception of the physician, showing more positive responses in the structured group.

The mean number of items recalled was 8.12 ± 4.31 (*N* = 57) in the structured condition and 5.71 ± 3.73 (*N* = 41) in the nonstructured condition (*p* = 0.005). The mean for the whole sample was 7.11 ± 4.23 items. Table 2 lists the percentage of participants who correctly recalled each item. Of the 57 participants in the structured condition, 33 spontaneously listed 3.45 ± 1.23 chapter headings in addition to factual items. Students who did not list chapter headings recalled 8.33 ± 4.4 items; those who did recalled 7.97 ± 4.27 items (n.s.). None of the covariates (prior medical knowledge, age, gender, sense of well-being, ability to concentrate, perception of the physician) influenced the number of items recalled.

4. Discussion and Conclusion

4.1 Discussion

Our findings show that the number of items of information that experts considered essential for patients being discharged from the emergency department by far exceeded participants' recall capacity [18]. This finding could have major consequences for clinical practice and teaching. Assuming that medical information has one primary goal, namely to enable the patient to make informed choices, the elements of information provided need to be limited to a number that patients

can retain in memory and use during the decision-making process. In other words, the amount of oral information transmitted needs to be drastically reduced.

So how can health professionals identify the elements that are truly essential for a patient to know? In the context of our study, information on red flags signalling that the patient should return to the emergency department is essential because it might save a patient's life. Another crucial piece of information is arguably how to prevent another vascular event by adhering to prescribed drugs and dosages. Yet our results showed that information on red flags and medication was not well recalled [35].

A second major result is that a simple communication technique improves recall of medical information. To our knowledge, this is the first cognitive intervention in a clinical setting to implement the suggestions of authors such as Doak and Doak [29] and Ley (e.g. [22]), who argued that structured information is easier to recall than nonstructured information. However, these authors did not provide strong evidence to support this hypothesis. Studies with chess players have convincingly demonstrated that people retrieve information much better when it is organised along familiar structures: master chess players recalled the position of pieces in a chess game with an incredible precision of 93% after a presentation time of only 5 seconds [36], and fared much worse when they were asked to recall the position of randomly placed pieces [37].

One might argue that recall in the present study would have been better if participants had been given longer to complete their recall protocols. We doubt this to be the case, because almost all participants finished within 5 minutes in a pre-pilot test. Even if the time allotted were too short, this would primarily have disadvantaged students in the structured condition, where there was more information to be recalled, namely, chapter headings in addition to factual information.

Indeed, the observation that many students in the structured group spontaneously wrote down chapter headings in addition to factual items was an interesting and unexpected finding. These students apparently dealt with chapter headings in a similar way as they did single items of factual information. One might argue that the imposition of structure renders necessary the provision of more elements of information, with detrimental effects on recall—specifically, that increased memory load decreases the likelihood of recall of target items in the structured condition. However, we showed, first, that structure improved recall of target items and, second, that there was no difference in the number of factual items recalled by students who wrote down chapter headings and those who did not. Therefore, the price of structure—even more information—is a price worth paying.

It seems likely that the better recall of students in the structured condition can be attributed to "chunking": the ability to form high-level clusters of information from low-level individual elements [38-40]. The concept of a "chunk" referring to a pattern of other symbols has been studied

as a model of memory organization. It has, for example, been used to explain why more elaborate prior knowledge can lead to an increased ability to extract information from the environment [38].

The recall of chapter headings or a table of contents in addition to single items may be of specific importance because it can help patients to define gaps in their knowledge. For example, a patient discharged from the emergency department may later tell his partner: “Then she told me something about the treatment plan, but I don’t actually remember what she said.” This patient would be better prepared to prompt the physician to repeat the information subsumed under this heading at their next encounter.

4.2 Limitations

Roughly two-thirds of the first-year psychology students approached responded to our invitation to participate in the present study. We do not know whether selection bias had any influence on recall. If one assumes that respondents are better motivated than nonrespondents, it would mean that our results tend to overestimate recall in a less motivated population. Along similar lines, one might argue that a sample of young psychology students is not representative of the average patient newly diagnosed with coronary heart disease. The question is whether this mismatch induced a bias in favour of the intervention, or whether the results should be interpreted with special caution. First-year psychology students are probably better trained and capable of storing new information than the typical 60-year-old with less formal education. Therefore, our results might in fact overestimate the number of items that typical patients are able to recall. On the other hand, it is possible that students are less motivated than real patients to recall information because they are not directly affected by it.

It is difficult to predict whether the book structure will be of more or less help to real patients than to well-educated young students, but it seems reasonable to assume that the less prior knowledge an individual has, the more helpful the combination of single items with structure will be. Thus, a patient who is able to link new information to existing knowledge or to organise new information along logical or associative strings will have better recall. The present results pertain primarily to patients with little or no prior knowledge of their condition. This generally holds for patients in an emergency situation, but may not apply to patients with chronic conditions, who consult for the same problem repeatedly and themselves acquire a continuously growing medical knowledge. Future research needs to examine whether, for example, more knowledgeable students recall more items and reap less benefit from the structuring of information.

4.3 Conclusions

A necessary condition for shared decision making in health care is informed patients who are knowledgeable about the consequences of a given diagnosis or a certain treatment. In order to make informed decisions, patients must be able to store information in memory and recall it when necessary. On average, study participants recalled 7 of a total of 28 items of information that were deemed essential by expert physicians. Structuring information according to the book metaphor improved recall from 5.7 items in the nonstructured condition to 8.1 items in the structured condition.

4.4 Practice implications

Two findings merit special attention: First, if patients recall about 7 new items (as our findings suggest), it is likely that all patients are overwhelmed by information in typical patient–physician communication. Clinicians must therefore decide which information is absolutely crucial and which information can be tailored to the patient's individual needs. This calls for action on the clinicians' part: In addition to the development of extensive information material, a consensus must be reached on which information on a given disease, diagnosis or treatment is truly essential. Second, more research is needed on the merits and limits of the book metaphor, and on the efficacy of training programs in the use of this technique.

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Information Structuring Improves Recall of Emergency Discharge Information

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Abstract

Information provided at discharge can have important effects on many health outcomes. However, patients often recall only a limited set of information provided by physicians at discharge. Information structuring such as the use advance directives can have positive effects on information recall but its benefits have not been extensively explored in emergency discharge situations. We examined the extent to which structuring discharge information improved recall in three groups differing in medical knowledge. Specifically, three groups of young adults, *first year psychology students* (n = 98), *first year medical students* (n = 97), and *third year medical students* (n = 39) were exposed to one of two videos showing a typical emergency discharge communication. Patient, physician, and content were identical between videos but one video showed structured (S) while the other non-structured (NS) discharge information. The structured discharge information led to improved recall relative to non-structured discharge information (M = 9.70, SD = 4.96 vs. M = 8.31, SD = 4.93, items). Moreover, while structured discharge information led to improved recall in *first year psychology students* (M = 8.12, SD = 4.31 vs. M = 5.71, SD = 3.73, items) and *first year* medical students (M = 9.95, SD = 5.03 vs. M = 8.76, SD = 4.49, items), it did not lead to a significant improvement in *third year medical students* (M = 13.5, SD = 4.48 vs. M = 13.0, SD = 4.49, items). Overall, these findings suggest that structured discharge information can be a powerful tool to improve recall of information and possibly benefits mostly populations with lower levels of medical knowledge.

Introduction

The importance of discharge information

Efficient communication between physician and patient represents a fundamental element of health care (1). By extension, ineffective communication is likely to adversely affect patients' satisfaction, trust, willingness to cooperate, and health status (2-5).

Efficient physician-patient communication in the context of the emergency department (ED) may be particularly challenging. According to the Society for Academic Emergency Medicine's Task Force on Physician-Patient Communication (6), numerous features of the emergency department (ED) environment render effective physician-patient communication difficult, including the absence of an established relationship with the patient, environmental factors (e.g., time, noise, interruptions, lack of privacy), stressors on the patient (e.g., pain, fear, anxiety), and stressors on the emergency physician (e.g., high-impact decisions, stimulus overload, biorhythm disturbance). Furthermore, patients presenting to the ED are disproportionately likely to have unhealthy lifestyles (e.g., substance abuse, violence), diminished rights (e.g., psychiatric patients, patients with intellectual disabilities, prisoners, undocumented workers), unrealistic expectations, and complex social problems (6). Finally, patients presenting to the ED are very heterogeneous concerning medical knowledge, experience with the health care system, language fluency, and health literacy (7). The ED thus represents a unique challenge to effective communication.

Discharge from the Emergency department is a period of high vulnerability for many patients (7). Emergency physicians play a key role in facilitating continuity of care and as a link to the primary care provider (8, 9). Inappropriate communication at discharge may result in adverse events, most often related to incorrect adherence to medication and lack of follow-up on pending test results. Effective physician-patient communication at discharge - that is,

communication which enables patients to understand and recall medical information - is therefore a crucial aspect of patient care that can lead to improved patient outcomes, including higher patient satisfaction (10), better adherence to medication (10, 11), more adequate disease management (12), and reduced anxiety (13). Unfortunately, effective discharge communication appears to be the exception rather than the rule: Even in immune-compromised patients, for whom knowledge of medication is crucial to treatment success, knowledge of recommendations at discharge is merely moderate (14).

Systematic literature reviews suggest a number of possible interventions that may improve discharge communication (7, 15), such as standardizing the information (7). One way to standardize communication is to provide written information (16); however, this is not always possible when information needs to be tailored to a specific patient, patient literacy is low, or the diagnosis is unclear. A more feasible alternative is to ensure that oral communication adheres to certain structural characteristics.

Information structuring

Psychological theory and associated empirical findings suggest that information structuring can be a powerful tool in improving memory recall and understanding. In a seminal study investigating the influence of structure on learning, Epstein (17) showed that verbally structured material was better learned and later recalled than unstructured material. Another study demonstrated that healthy students' (but not process schizophrenics') accuracy of recall was higher for a word list presented in structured than in unstructured order (18). A study investigating the effect of students' ability and type of instructional program (structured vs. unstructured) on performance in easy and difficult test items showed that high- and medium-ability students performed better in the structured program (19). Meta-analyses on the use of a specific type of information structuring, namely, advance organizers - i.e.,

information presented by an instructor with the goal of helping the learner organize new incoming information - suggest that structure can indeed assist learning: Hattie (20) estimated an overall positive effect size of .4 on learning from 11 meta-analysis of 577 studies (N = 3905). One likely psychological mechanism underlying the benefits of information structuring appears to be chunking, that is, the association of disparate low-level individual elements into large high-level clusters (21). Indeed, the ability to form high-level clusters has been directly linked to increases in recall capacity, making it a useful tool for memorizing large amounts of information (22-24).

How the structure implied by prior knowledge affects memory performance has been studied extensively in research on human memory (25-28) and it is thought that "prior knowledge facilitates processing of new incoming information, supposedly because it provides a structure into which the new information can be integrated, which may lead to an elaborated memory trace" (29). Considering the role of information structuring in discharge communication, one may predict that its benefits are largest when there is no prior internal structure that can guide information encoding. In other words, externally imposed structure in discharge communication may prove most beneficial to those who lack prior medical knowledge. The extent to which structuring the presentation of discharge information may improve patients' information recall and how such benefits are moderated by the presence of relevant medical knowledge has not yet been systematically examined.

The Current Study

To date, the power of information structuring has primarily been studied in the laboratory; no previous studies have investigated its role in improving discharge information delivery. Could information structuring also improve patients' recall and understanding of discharge information? Studying these questions experimentally in the ED would be

demanding and potentially stressful for ED patients. In this hypothesis-generating phase, we therefore decided to use students as proxy patients. We thus adopt a similar strategy to previous studies, which have used proxies, such as health care professionals or family caregivers, to evaluate certain patient outcomes, such as health-related quality of life (30), functional ability (31), or symptoms (32).

Our study presented three different populations differing in their medical knowledge with either a structured or non-structured discharge communication video. The two videos simulated a discharge communication event in which a physician communicated 28 items of information to a patient with acute chest pain. The information provided stemmed from previous work that identified the desired content of effective discharge communication in patients presenting with acute chest pain (33). The structured information video provided participants with the items clustered by topic (e.g., diagnosis, follow-up appointment, medication). In turn, the non-structured video provided the same information in an arbitrary order. The present study was therefore designed to examine whether information structuring can lead to improved recall of information and determine whether potential benefits of information structuring are differentially useful to individuals with different levels of medical knowledge.

Materials and Methods

Design Overview

We conducted a prospective cross-sectional multicenter trial at the Universities of Basel, Switzerland, and Mannheim, Germany, using a 3x2 between-subjects experimental design, the factors being "condition" (structured vs. non-structured) and "group" (*first year psychology students vs. first year medical students vs. third year medical students*) and the dependent variable being number of items recalled. The study protocol

(http://www.clinicaltrials.gov ID NCT01540266) was approved by the local ethics committees (Ethikkommission Nordwestschweiz). Written informed consent was obtained from all participants. Psychology students received study credits for participation.

Setting and Participants

The study was conducted during regular weekly lectures in two auditoriums at the Universities of Basel and Mannheim. We recruited three independent populations: *first year medical students* at the University of Mannheim (n = 97), *third year medical students* at the University of Basel (n = 39), and *first year psychology students* at the University of Basel (n = 98). Using students as proxy patients, we investigated whether structuring discharge information had any benefit for recall and possible correlations with the level of medical knowledge.

Randomization and Interventions

The study flow is shown in Fig. 1. Students were randomly assigned to either the structured (S) or the non-structured (NS) condition at the outset of the lecture. They received written information about the study and were told that their task was to take a patient's perspective and evaluate the communication between physician and patient shown in a video. The two groups were then independently shown a video in which the same physician (Fig. 2) conveyed the identical 28 items of information to an older patient (played by an actor) in either structured or non-structured form. The physician's communication was judged as friendly and did not involve the use of medical jargon. However, in the non-structured (NS) condition, the information presented had no *explicit* structure. In the structured (S) condition, the information was well structured, following the structural elements of a book, in which the content is presented in a specific order, typically advancing from high-level information (e.g.,

title, table of contents, chapter headings) to detailed, low-level information (e.g., text, annexes). Following this book structure (34), the physician started the interaction as follows:

Mr. Lehmann, I will now give you some *discharge information* (TITLE).

Before you go home, there are five points that I would like to inform you about (TABLE OF CONTENTS)

First: What is your diagnosis?

Second: What will happen next?

Third: What can you do yourself?

Fourth: What do you have to pay attention to in order to be on the safe side?

Finally, the fifth and last point: What will the treatment look like?

Let me start with the first point: What is your diagnosis (1st CHAPTER HEADING):

The good news is that you don't have a myocardial infarction ….. (TEXT).

Fig. 1. Study flow

Fig. 2. Screenshots from the discharge communication videos shown to participants

Participants were asked to imagine being in the patient's position while viewing either a structured or an non-structured communication event and were not informed of the upcoming memory test

The elements included were defined after careful discussion among three expert physicians (with more than 12 years of experience in emergency medicine and psychosomatic medicine, respectively; co-authors). After receiving input from (n=51) patients and (n=47)

experts (33) they agreed on 28 items of information that they considered useful for a patient with angina pectoris at discharge and after exclusion of myocardial infarction.

After watching the video, participants were given 5 minutes to take down all the items of information they remembered (immediate recall). In addition, they were asked to rate the comprehensibility of the physician, the structure of the dialogue, and their willingness to recommend the physician to friends and relatives on a Visual Analogue Scale (VAS; from 0 to 10). Participants' current mood and level of attention was also assessed using a VAS to test for moderating effects of their current status. Their medical knowledge was tested by a multiple choice test comprising six questions (Table 1). Additionally, the following variables were recorded: gender, age, nationality, number of semesters completed, faculty, and university. In order to maintain anonymity, we asked participants to mark their questionnaires with a personalized code.

Table 1. Multiple choice questions used to assess participants' medical knowledge (correct answers in bold).

	Question	Answers
Q1	A myocardial infarction is	A: a sudden irregularity of the cardiac pulse/rhythm leading to severe pain B: a gradual narrowing of the heart's coronary vessels C: a sudden weakness of the cardiac muscle **D: death of part of the cardiac muscle due to lack of oxygen**
Q2	Angina pectoris is defined as	A: dyspnea caused by disturbed heart rhythm B: pain caused by an overstrained heart

		C: pain caused by short-term underoxygenation of the cardiac muscle
		D: disturbed heart rhythm caused by short-term of the cardiac muscle
Q3	What is a risk factor for cardiovascular diseases?	A: heavy work (physical labor, intensive sports) **B: diabetes mellitus** C: frequent viral infections D: electromagnetic radiation (e.g., from a cell phone)
Q4	Typical pain sensations in myocardial infarction	A: increase during inhalation **B: radiate into the left arm** C: occur with sudden limb movement D: radiate from the left thorax to the right thorax
Q5	A cardiac angiography is	A: an ultrasound of the coronary vessels B: a computed tomography (CT) of the coronary vessels C: an ultrasound of the heart **D: a radiographic examination of the coronary vessels**
Q6	Typical cardiac pain worsens with	A: rapid breathing B: emotional stress **C: physical exertion** D: lifting of both arms

Outcome Measures

The key memory measure of interest was immediate recall performance expressed as the number of items recalled. Participants' recall protocols were evaluated by two independent raters, one of whom rated all protocols and the other, only a subset of them. Analyses of the agreement between the two raters resulted in a Cohen's kappa of 0.74, indicating substantial interrater reliability according to Landis and Koch (35). In case of disagreement between the two raters, consensus was reached through joint analysis and discussion of the protocols.

Statistical Analyses

All analyses were performed with SPSS for Windows, v. 18 (SPSS Inc., Chicago, USA). The difference in recall performance between each pair of the three groups (main effect of "group": *first year psychology students* vs. *first year medical students*; *first year psychology students* vs. *third year medical students*; *first year medical students* vs. *third year medical students*) and between the two conditions (main effect of "condition": structured vs. non-structured discharge information) as well as their interaction "group x condition" was assessed by the means of a 2x3 analysis of variance (ANOVA). Non-parametric Mann-Whitney tests were performed to probe for inter- and intragroup differences in medical knowledge of *first year psychology students, first year medical students*, and *third year medical students*. A t-test analysis was used to compare differences between the structured and non-structured conditions in terms of participants' VAS ratings of the comprehensibility of the physician, the structure of the dialogue, willingness to recommend the physician to friends and relatives, current mood, and level of attention. Finally, in order to establish the independence of the main effects "group" and "condition" as well as their interaction "group x condition" from the influence of current mood, and level of attention on the number of

recalled items, we performed a 2x3 analysis of covariance (ANCOVA), again number of recalled items being the dependent variable and "group" (*first year psychology students* vs. *first year medical students*; *first year psychology students* vs. *third year medical students*; *first year medical students* vs. *third year medical* students) and "condition" (structured vs. non-structured) being the factors. All tests were performed at a significance level of $\alpha = 0.05$.

Results

Recall

Demographics of the study sample are summarized in Table 2. The ANOVA revealed a significant main effect of "condition", $F(1, 228) = 4.45$; $p = 0.036$; $\eta_p^2 = 0.019$, albeit with a small effect size, $d = 0.28$ ($d = 0.2$, 0.5, and 0.8 represent effects of small, medium, and large size, respectively; (36)). Overall, the 234 participating students recalled a mean of 9.12 of the 28 items (33%) presented (range: 0-23 items). Students randomized to the structured condition recalled a mean of 9.70 items (35%); those randomized to the non-structured condition recalled a mean of 8.31 items (30%). The main effect of "group" on recall performance proofed also to be significant, $F(1, 228) = 27.9$; $p < 0.01$; $\eta_p^2 = 0.196$. The *third year medical students* recalled the highest number of items ($M = 13.2$, 47%, range: 4-23), followed by the *first year medical students* ($M = 9.47$, 34%, range: 0-19), and the *first year psychology students* ($M = 7.11$, 25%; range: 0-19). Each comparison between pairs of groups was statistically significant (*first year psychology students* vs. *first year medical students*: $p < 0.01$; $d = 0.52$; *first year psychology students* vs. *third year medical students*: $p < 0.01$; $d = 1.43$; *first year medical students* vs. *third year medical students*: $p < 0.01$; $d = 0.80$).

Table 2. Participants' demographic characteristics, medical knowledge, VAS ratings and primary findings.

Characteristic	Overall			First year medical students			First year psychology students			Third year medical students		
	Overall (*n* = 234)	**S (*n* =136)**	**NS (*n* = 98)**	**Overall (*n* = 97)**	**S (*n* = 59)**	**NS (*n* = 38)**	**Overall (*n* = 98)**	**S (*n* = 57)**	**NS (*n* = 41)**	**Overall (*n* = 39)**	**S (*n* = 20)**	**NS (*n* = 19)**
Demographics	70(30)	40(29)	30(31)	43(44)	26(44)	17(45)	16(16)	10(17)	6(15)	11(28)	4(20)	7(37)
Male sex, n(%)	216(92)	122(90)	93(95)	93(96)	55(93)	37(97)	85(87)	57(100)	37(90)	38(97)	20(100)	19(100)
German mother tongue, n(%)	22(3.6)	22(3.1)	22(4.1)	21(3.3)	21(3.1)	22(3.6)	22(3.8)	22(3.5)	22(4.3)	23(3.3)	22(0.9)	24(4.5)
Age (y), *M*(*SD*)												
Medical medical knowledge	156(67)	91(67)	65(66)	92(95)	55(93)	37(97)	27(28)	17(30)	10(24)	37(95)	19(95)	18(95)
Correct answer Q1, *n*(%)	190(81)	106(78)	84(86)	85(88)	50(85)	35(92)	67(68)	37(65)	30(73)	38(97)	19(95)	19(100)
Correct answer Q2, *n*(%)	164(70)	90(66)	74(75)	84(87)	50(85)	34(89)	41(42)	20(35)	21(51)	39(100	20(100)	19(100)
Correct answer Q3, *n*(%)	200(85)	120(88)	80(82)	94(97)	59(100)	35(92)	68(69)	41(72)	27(65)	38(97)	20(100)	18(95)
Correct answer Q4, *n*(%)	124(53)	70(51)	54(55)	66(68)	39(66)	27(71)	27(28)	16(28)	11(26)	31(79)	15(75)	16(84)
Correct answer Q5, *n*(%)	193(82)	115(85)	78(80)	87(90)	51(86)	36(95)	68(69)	45(79)	23(56)	38(97)	19(95)	19(100)
Correct answer Q6, *n*(%)												
VAS ratings (0-10)	7.0(2.4)	7.9(2.0)	5.7(2.3)	7.3(2.3)	8.2(1.8)	5.9(2.3)	7.2(2.2)	8.0(1.9)	6.1(2.2)	5.6(2.6)	6.8(2.3)	4.2(2.1)
Comprehensibility, *M*(*SD*)	7.0(2.7)	8.4(1.7)	5.0(2.6)	7.2(2.7)	8.6(1.8)	5.0(2.4)	7.2(2.6)	8.5(1.5)	5.5(2.7)	6.2(2.8)	8.0(1.7)	4.3(2.4)
Dialogue structure, *M*(*SD*)	6.2(2.7)	7.1(2.4)	4.9(2.6)	6.2(2.7)	7.2(2.3)	4.8(2.5)	6.5(2.7)	7.1(2.7)	5.8(2.6)	5.0(2.7)	6.7(2.2)	3.4(2.3)
Willingness to recommend, *M*(*SD*)	6.2(1.7)	6.2(1.8)	6.4(1.7)	6.0(1.7)	6.0(1.7)	6.1(1.9)	6.5(1.8)	6.5(1.8)	6.5(1.8)	6.2(1.6)	5.9(1.7)	6.4(1.5)
Current mood, *M*(*SD*)	6.0(7.8)	6.2(1.7)	5.7(1.9)	5.7(1.7)	5.8(1.6)	5.6(1.8)	6.1(1.9)	6.5(1.7)	5.6(2.0)	6.1(1.7)	6.3(1.4)	5.9(2.0)
Level of attention, *M*(*SD*)												

Primary findings	9.12	9.70	8.31	9.49	9.95	8.76	7.11	8.12	5.71	13.23	13.45	13.00
Number of items recalled, *M*	0-23	0-23	0-19	0-19	0-19	0-18	0-19	0-19	0-18	4-23	5-23	4-19
Range	4.98	4.96	4.93	4.84	5.03	4.49	4.84	4.31	3.73	4.43	4.48	4.49
Standard deviation												

1

2

3

Next, we considered the potential benefit of structure as a function of medical knowledge (Fig. 3). Although the interaction of "condition x group" proved to be statistically non-significant ($F(2, 228) = 0.80$; $p = 0.45$; $\eta_p^2 = 0.007$), the magnitude of the effects of information structuring seems to vary systematically by the degree of medical knowledge: although only a negligible difference of structured information could be observed in *third year medical students* ($M_S = 13.5$ vs. $M_{NS} = 13.0$; $d = 0.12$), we found a small effect size of information structuring in *first year medical students* ($M_S = 9.95$ vs. $M_{NS} = 8.76$; $d = 0.24$), and a medium effect size in *first year psychology students* ($M_S = 8.12$ vs. $M_{NS} = 5.71$; $d = 0.60$).

Fig. 3. Recall

Number of items recalled by participants in the structured and non-structured conditions, separately for each group

Medical Knowledge

A Mann-Whitney U-test of differences in participants' medical knowledge confirmed that the three groups had different degrees of expertise in the area: *first year psychology students'* performance in each of the six multiple choice questions was significantly worse than that of *third year medical students* or *first year medical students* (Table 3). Comparison of the percentage of correct answers provided by the two groups of medical students (Table 2) shows that the *third year medical students* performed better in four of the six questions and equally well in the remaining two. However, the *U* test analyses showed a significant difference between these two groups only in one question (Q3; see Table 3).

Table 3. Results from Mann-Whitney U-tests of differences in participants' medical knowledge.

	First year medical students* vs. *first year psychology students		***First year medical students* vs. *third year medical students***		***First year psychology students* vs. *third year medical students***	
	U	*P*	*U*	*P*	*U*	*p*
Q1	1552	< .01*	1891	.99	623	< .01*
Q2	3722	< .01*	1705	.10	1352	< .01*
Q3	2619	< .01*	1638	.02*	799	< .01*
Q4	3443	< .01*	1881	.87	1374	< .01*
Q5	2673	< .01*	1675	.18	878	< .01*
Q6	3691	< .01*	1744	.17	1373	< .01*

Note: * indicate statistically significant differences between the two groups tested.

Subjective Measures and Additional Covariates

T-test analyses of participants' subjective ratings showed that participants in the structured condition rated the quality of communication significantly higher than did participants in the non-structured condition on all three attributes: comprehensibility of the physician, structure of the dialogue, and willingness to recommend the physician to friends and relatives (overall as well as across the three subgroups; Table 4 and Fig. 4). No differences were observed in the ratings of current mood (Table 4). Among *first year psychology students*, reported attention levels were significantly lower in the NS condition than in the S condition. However, no corresponding differences between the conditions were observed for *first year medical students* or *third year medical students* (Table 4).

Table 4. Results from *t* tests of differences in VAS ratings.

	Overall S > NS				First year medical students S > NS				First year psychology students S > NS				Third year medical students S > NS			
	T	*df*	CI	*P*	*T*	*Df*	CI	*p*	*t*	*df*	CI	*p*	*t*	*df*	CI	*p*
Comprehensibility	7.76	186	1.67-2.84	<0.01*	5.36	95	1.43-3.12	<0.01*	4.59	96	1.09-2.76	<0.01*	3.70	37	1.19-4.06	<0.01*
Dialogue structure	11.50	155	2.81-3.99	<0.01*	7.82	62	2.66-4.49	<0.01*	6.38	58	2.08-3.98	<0.01*	5.70	37	2.41-5.10	<0.01*
Willingness to recommend	6.43	232	1.49-2.80	<0.01*	4.86	95	1.44-3.43	<0.01*	2.43	96	0.24-2.37	0.02*	4.61	37	1.81-4.70	<0.01*
Current mood	-0.78	232	-0.63-.027	0.44	-0.51	95	-0.91-0.54	0.61	-0.04	96	-0.74-0.72	0.97	-1.07	37	-1.57-0.48	0.30
Level of attention	1.12	232	0.04-0.97	0.04*	0.65	95	-0.46-0.92	0.52	2.24	96	0.10-1.63	0.03*	0.66	37	-0.76-1.50	0.51

Note: * indicate statistically significant differences between the two groups tested.

Fig. 4. VAS ratings

Participants' ratings of the comprehensibility of the physician, the structure of the dialogue, and willingness to recommend the physician to friends and relatives as a function of whether they viewed the structured or the non-structured video

The ANCOVA revealed the following (Table 5): The main effect of group on the number of recalled items remained statistically significant with control for either covariate (current mood, attention level). The main effect of condition on the number of recalled items remained statistically significant with control for current mood and marginally statistically significant with control for level of attention. The interaction "condition x group" remained statistically non-significant with control for either covariate. Thus, the main effects "condition" and "group" as well as their interaction "condition x group" proved to be independent from the two covariates.

Table 5. Results from the ANCOVA with main effects of condition (c) and of group (g) and their interaction condition x group (c x g); and current mood and attention level as covariates.

	current mood			attention level		
	C	**g**	**c x g**	**c**	**g**	**c x g**
F	4.51	27.8	0.77	3.25	28.6	0.59
df	1, 227	2, 227	2, 227	1, 227	2, 227	2, 227
p	0.035*	<0.01*	0.46	0.073	<0.01*	0.55
η_p^2	0.019	0.20	0.007	0.014	0.20	0.005

Note: * indicate statistically significant differences between the two groups tested.

Discussion

Our study suggests that information structuring can improve information recall. Second, we find a trend such that medical knowledge was associated with recall performance, namely, the group of participants with lowest levels of medical knowledge had the strongest benefits from information structuring on information recall. Third, the presentation of structured information also resulted in higher ratings in terms of perceived structure, comprehensibility, and willingness to recommend this physician to friends and relatives.

Taken together, these results suggest that subjects with little medical knowledge may benefit substantially from a structured discharge information. In contrast, structure appears to have no or little benefit on recall in subjects with higher medical knowledge, such as advanced medical students. It could be argued that medical knowledge enables the receiver of information to store it more efficiently (29), even when its presentation lacks a defined structure. With respect to the generalization of our findings, two points may warrant attention: First, of the three groups we studied, the group of *first year psychology students* is most similar to patients (little medical knowledge). On the other hand, our results are more likely to *underestimate* the benefit of structuring information, as the recall in patients is most likely lower than in students. Second, patients with chronic conditions may have more pertinent medical knowledge. They may better be able to integrate even unstructured information into existing knowledge structures and categories.

The relationship between structure and subsequent recall performance has previously been studied but in very different circumstances (17-19). Our results converge with previous findings: structure results in better recall than lack of structure in particular when no pertinent medical knowledge is accessible. Hannafin (19), however, found that high- and medium-ability (and not low-ability) students performed better in a structured program than in an

unstructured program. In contrast to these findings, we did not assess students' ability but rather their preexisting knowledge in the field. Further studies might address a combined evaluation of these parameters.

Our study has a number of limitations. One limitation concerns the presentation of information: To be able to standardize the presentations, we used video clips rather than real-life interactions. Real-life communication offers many opportunities to tailor information and speed of delivery to recipients' reactions: Subtle cues can indicate the need to slow down the delivery or to speed up because the recipient is more knowledgeable than the sender assumes. The staged interaction's representativeness of a real situation in the ED may thus be questioned. Yet, even in this highly constrained situation, we observed that participants' recall performance was far from perfect. In fact, even the best group recalled less than half of the information conveyed. Thus, even young, well-educated students, experts in submitting information to memory, were overtaxed. This finding strongly suggests that the amount of information presented in clinical interactions has to be considered much more carefully, supporting previous findings (33).

Future research evaluating the benefits of structure in the presentation of discharge information will, of course, need to focus on actual interactions between patients presenting to the ED and emergency physicians. Nevertheless, we hope our results represent a further step towards a more effective physician-patient communication.

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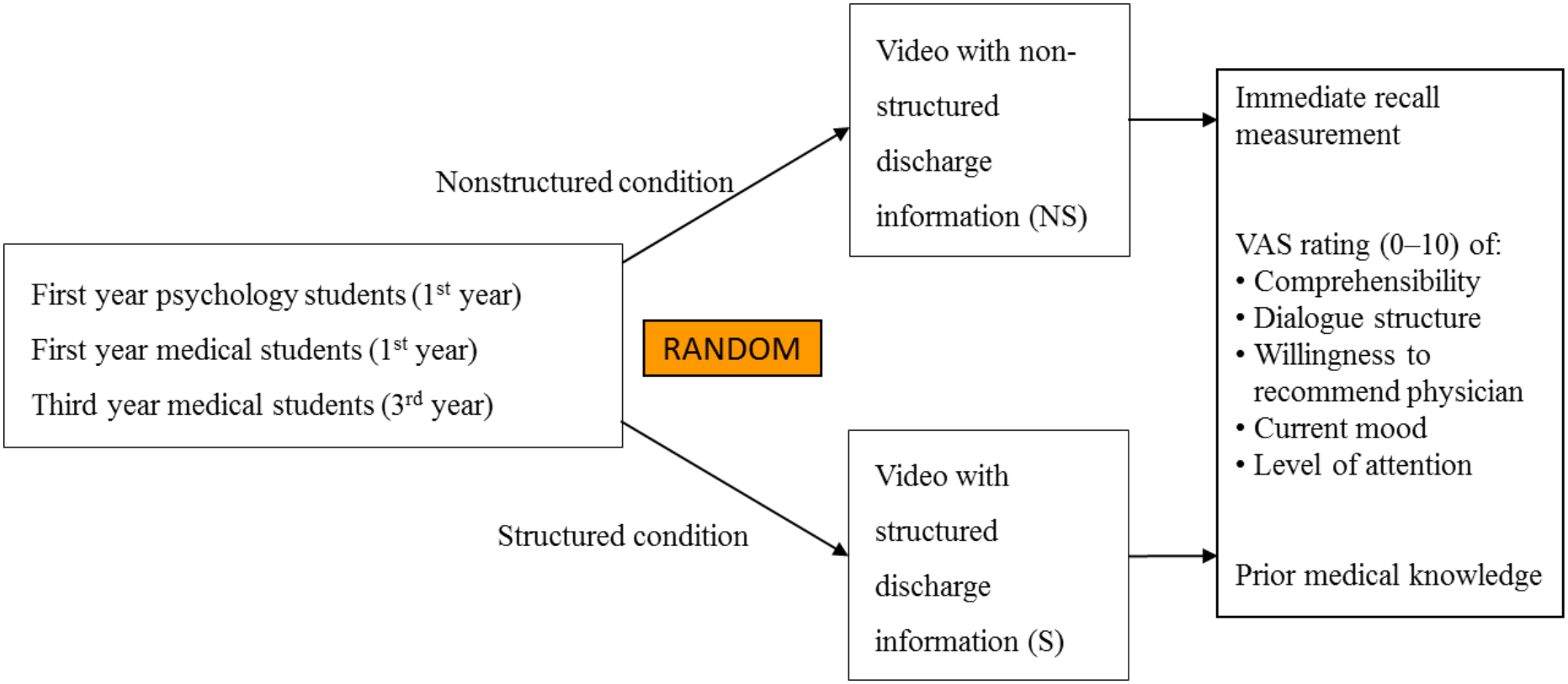
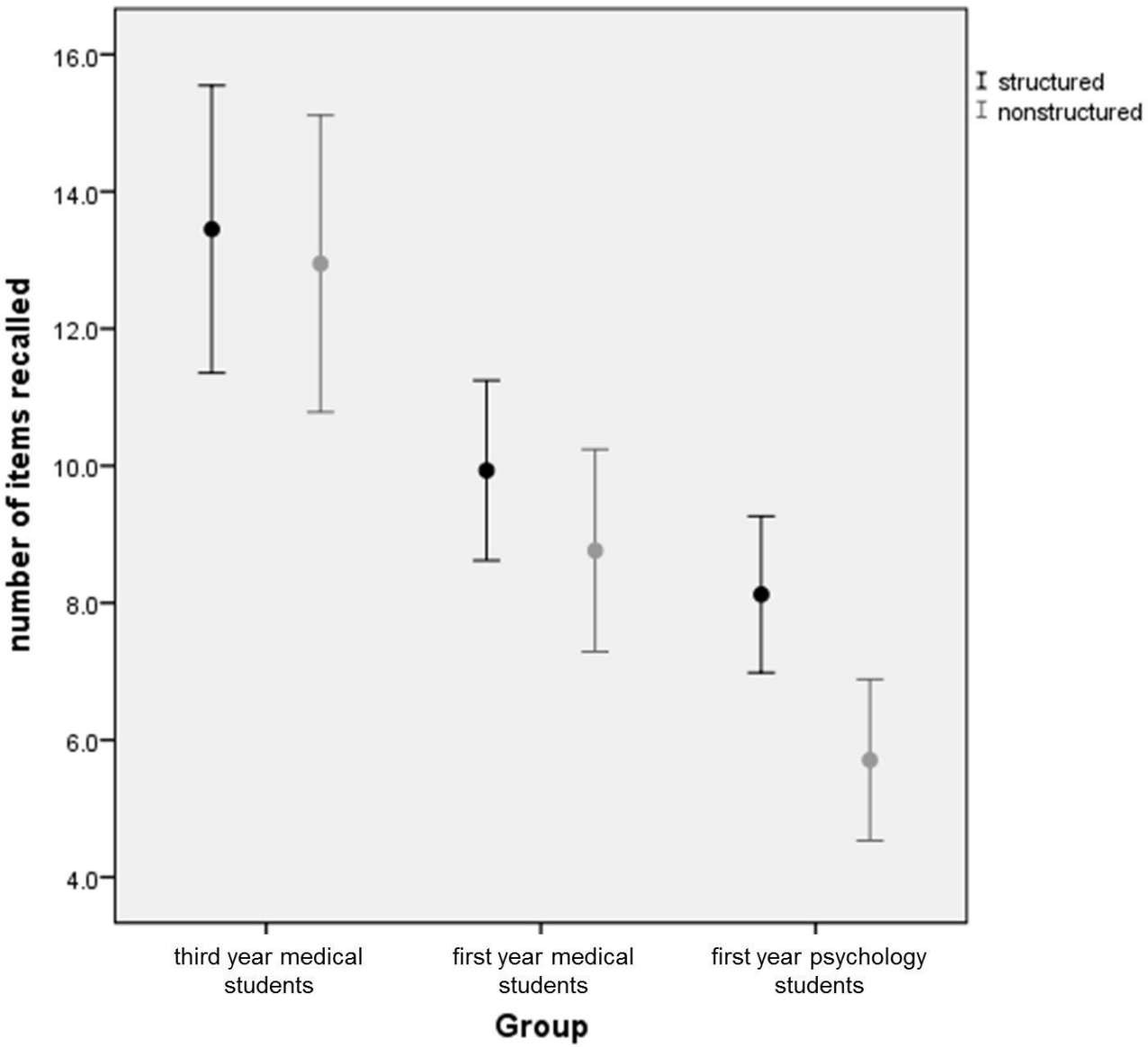
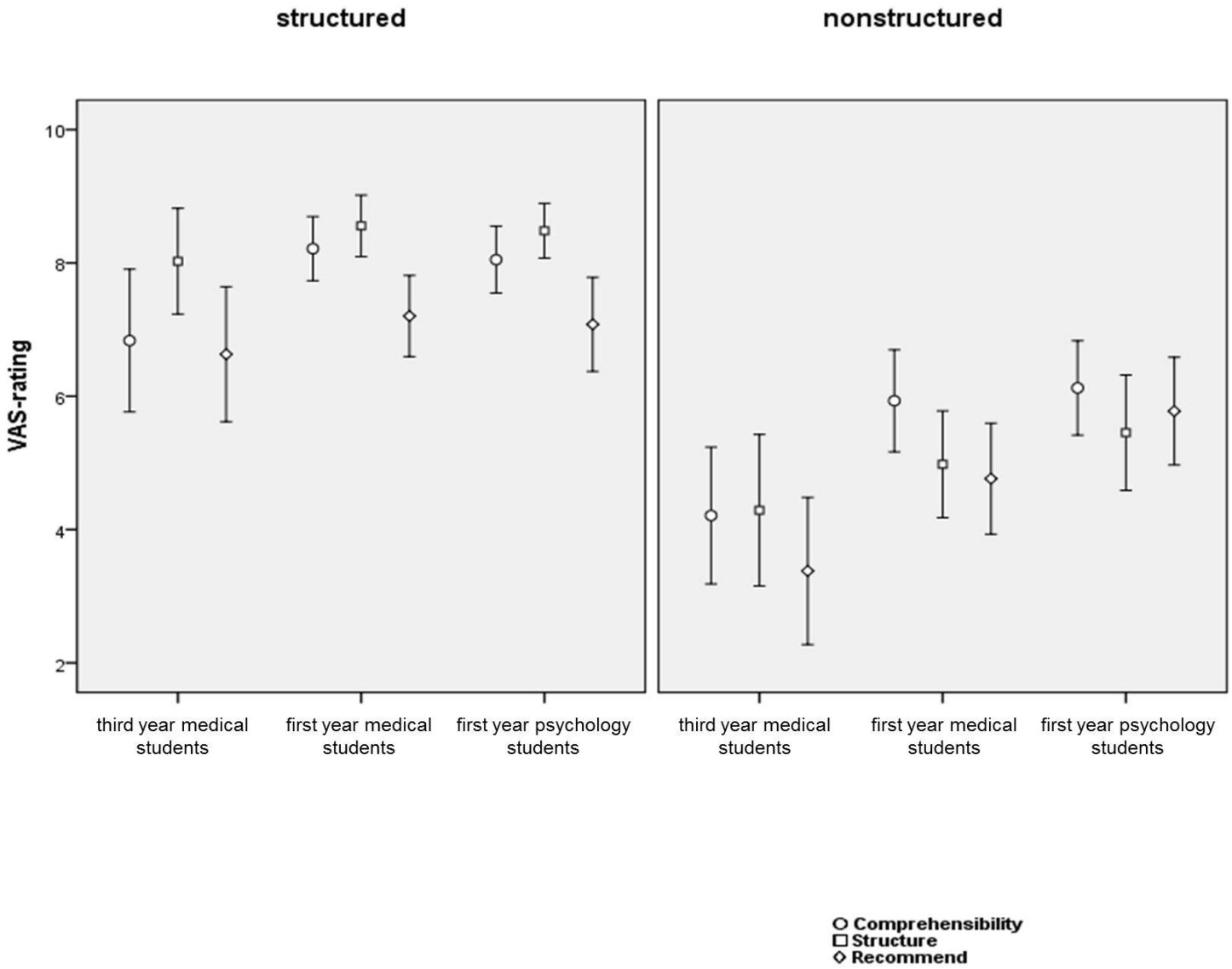

First year psychology students (1st year)
First year medical students (1st year)
Third year medical students (3rd year)
RANDOM
Nonstructured condition
Structured condition
Video with non-structured discharge information (NS)
Video with structured discharge information (S)
Immediate recall measurement
VAS rating (0–10) of:
• Comprehensibility
• Dialogue structure
• Willingness to recommend physician
• Current mood
• Level of attention
Prior medical knowledge


16.0
14.0
12.0
10.0
8.0
6.0
4.0
number of items recalled
structured
nonstructured
third year medical students
first year medical students
first year psychology students
Group


structured
nonstructured
VAS-rating
10
8
6
4
2
third year medical students
first year medical students
first year psychology students
third year medical students
first year medical students
first year psychology students
Comprehensibility
Structure
Recommend