Impact of care-related regret on sleep and job quitting

COURVOISIER, Delphine

Abstract

Despite the great satisfaction they can find in their work, healthcare professionals are particularly at risk of various physical and psychological health problems, including back pain, depression, suicide, and burnout. While the causes of the health problems of healthcare professionals are multifactorial, one cause lies in the emotional burden associated with providing healthcare. Regret is a normal and frequent emotion, related to decision making, and associated both with positive outcomes, such as better learning, and negative outcomes such as sleep problems. This privat-docent thesis explores and supports various aspects of a theoretical framework on the causes and consequences of regret and regret coping.

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"Impact of care-related regret on sleep and job quitting"

Thesis submitted to the Faculty of Medicine of the University of Geneva

for the degree of Privat-Docent

by

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Summary

Despite the great satisfaction they can find in their work, healthcare professionals are particularly at risk of various physical and psychological health problems, including back pain, depression, suicide, and burnout. These problems often lead to prolonged sick leave, and have serious consequences on the organization of patient care, and (dramatic) costs for the healthcare system.

While the causes of the health problems of healthcare professionals are multifactorial, one cause lies in the emotional burden associated with providing healthcare. Many researchers focus on emotional burden in individuals who are already overwhelmed, for instance when studying burnout. In contrast, my field of research focuses on regret. Regret is a normal and frequent emotion, experienced by everyone. It is defined as the emotion felt if, looking back, it seems that another course of action would have been better. This emotion is particularly interesting because it is associated both with positive outcomes, such as better learning, and negative outcomes such as sleep problems.

In the context of clinical practice, regrets occur frequently. Physicians and nurses perform numerous clinical actions during their workday and have to take complex decisions under strong time pressure, and in a context of information overload, and uncertainty. The number of complex patients with multi-morbidities is also increasing along with the development of chronic diseases.

Dealing with healthcare-related difficult events (e.g., discovering that a patient is experiencing a lot of pain and should have received his analgesic medication half an hour earlier) relies on coping strategies. One classification of these strategies proposes two categories: problem-focused, and emotion-focused. Problem-focused strategies aim at preventing similar situations in the future, whereas emotion-focused strategies aim at dealing with the emotional burden associated with regret (suppressing regret-related thoughts, doing sport,...). In addition, social strategies ((i.e., seeking either an attentive ear or obtaining concrete support from others, such as a five-minute break) are either problem- or emotion-focused.

The articles included in this privat-docent thesis explore and support various aspects of a theoretical framework I developed with respect to the causes and consequences of regret and regret coping. The first article presented is a qualitative
study of 25 healthcare professionals (nurses and physicians) exploring the situations which elicited regret, the strategies used to cope with the regret, and how these regrets decreased over time, as well as the consequences felt by the healthcare professionals. The second and third articles describe the validation of two scales, one of regret intensity and one of regret coping, in a Swiss-French and Swiss-German sample, providing two validated scales in French and in German. The fourth and fifth publications examine the association between regret and the hypothesized outcomes, with the fourth article focusing on sleep problems, and the fifth article examining sick leave. A final publication, which is a letter published in the Lancet, aims at raising awareness on the subject of regret, with the goal of encouraging hospital leaders to implement trainings on regret coping.

The qualitative and cross-sectional quantitative surveys used for these six articles support the idea that regret is a relevant concern for healthcare professionals. Future studies, however, are needed to determine whether the impact of regret is causal, and whether we could act on regret and regret coping to reduce negative and favor positive consequences. The discussion presents a few designs of studies that aim at obtaining an answer to the question of causality. In short, assessing causality requires at least a longitudinal design with a relatively large cohort of healthcare professionals. Then, when (if) the causality is better established, obtaining an answer to the question of being able to modify regret coping requires a randomized controlled trial. Indeed, it is necessary to determine whether an intervention could help reduce the emotional burden on the healthcare professionals and, by doing so, reduce the negative impact of regrets, such as sleep problems, increase in sick day leaves, and loss of job satisfaction.
**Introduction**

Despite the great satisfaction they can find in their work, healthcare professionals are particularly at risk of various physical and psychological health problems, including back pain (e.g., prevalence among nursing home nurses: 19%\(^1\)), depression (metaanalysis of prevalence among medical doctors: 28.8%\(^2\)), suicide (2-fold increase in incidence among nurses and physicians\(^3\)) and burnout (prevalence among medical doctors: 42%\(^4\)). These problems often lead to prolonged sick leave\(^5\), and have serious consequences on the organization of patient care\(^6\), and (dramatic) costs for the healthcare system\(^7\).

While the causes of the health problems of healthcare professionals are multifactorial, one cause lies in the emotional burden associated with providing healthcare. Studies focusing on this emotional burden stem from various fields and cover overlapping but different aspects of the emotional life of a healthcare professional. Common concepts are: moral distress\(^8\), stress of conscience\(^9\), perception of inappropriate care provided to patients\(^10\), loss of control over the process of care\(^11\), and involvement in medical errors\(^12\). All of these concepts focus on the abnormal emotional states that healthcare professionals reach when events become overwhelming or when a medical error occurs. As such, the findings of these studies may be more difficult to translate into potential preventive measures compared to findings of studies on normal emotional states. Indeed, abnormal emotional states will only occur when the primary coping mechanisms have failed.

In contrast to studies on abnormal emotional states, my field of research focuses on regret. Regret is a normal emotion, experienced by everyone\(^13\), and is the second most frequently cited emotion of the daily life\(^14\). It is defined as the emotion felt if, looking back, it seems that another course of action would have been better. For instance, if healthcare professionals believe that a patient would have been better off if they had behaved differently, they will experience regret\(^15\). It is part of the counterfactual emotions, which occurs when the accompanying cognitive processes compare the real outcomes to what ‘might have been’. This emotion is particularly interesting because it is associated both with positive outcomes, such as better learning\(^16\), and negative outcomes such as sleep problems\(^17\)\(^\text{-}\)\(^19\). Indeed, regret is the negative emotion most often evaluated as beneficial, in terms of making
sense of the past, facilitating approach and avoidance behaviors when appropriate, and preserving social harmony.

In the context of clinical practice, regrets occur frequently. Physicians and nurses perform numerous clinical actions during their workday, and have to take complex decisions under strong time pressure, and in a context of information overload, and uncertainty. Furthermore, the number of complex patients with multi-morbidities is increasing along with longer life expectancy and the development of chronic diseases. Patients with multi-morbidities are at higher risk of an acute event during their hospital stay, of longer hospitalization and of palliative care, which may require life and death decisions. Again, these decisions may cause regrets if they later seem less than optimal (e.g., if the patient dies, experiences pain, becomes handicapped). Finally, not surprisingly, a large majority of medical interns admit having been involved in a medical error, which may cause regret later. Note, however, that regret can stem from situations that were not medical errors.

Dealing with healthcare-related difficult events (e.g., discovering that a patient is experiencing a lot of pain and should have received his analgesic medication half an hour earlier) relies on coping strategies. One classification of these strategies proposes two categories: problem-focused, and emotion-focused. Problem-focused strategies aim at preventing similar situations in the future (e.g., “I will make a change in my schedule to visit my patient on time” or “I will provide more pain medication in advance”). Emotion-focused strategies include suppression of regret-related thoughts (e.g., “It happened but let’s not think about it”). In addition, social strategies (i.e., seeking either an attentive ear or obtaining concrete support from others, such as a five-minute break) are either problem- or emotion-focused. How these strategies are used by physicians and nurses, and how effective they are in the context of healthcare, is still poorly understood.

In this introduction, I will first describe related fields of research focusing on regrets: anticipated regrets and clinical decision-making, regret-driven learning algorithms, and consequences of patients’ regrets of important medical decisions. I will then present a theoretical framework we developed to model the occurrence and consequences of regret.
Fields of research focusing on regrets

Anticipated regrets and clinical decision-making

While the influence of cognitive processes on medical decisions has been extensively studied\textsuperscript{28,29}, the impact of affective processes has still received less attention\textsuperscript{30,31}. Regret in particular plays a key role in many types of decisions\textsuperscript{14,32}, including medical decisions\textsuperscript{33-35}. For instance, prior to a medical decision, physicians’ intentions to vaccinate adolescents against human papilloma-virus are associated with anticipated regret of inaction\textsuperscript{35}.

Human-and clinical - decision-making is a process that is often performed in a situation of uncertainty. For instance, a physician making a therapeutic decision when she is not sure of the diagnosis will need to determine the probability that the patient has a specific disease and then decide whether the treatment harms may be too great compared to its benefits. The threshold model proposes that there is a threshold at which a physician is undecided (i.e., in technical terms, indifferent) between giving or not giving a treatment. There are three main types of threshold model.

1. Expected utility theory holds that a decision is selected based on the highest expected utility with the goal to maximize the valued outcome\textsuperscript{36,37}. This relatively old theory assumes that the healthcare professional’s choice is based on a rational process very close to what is used for cost-effectiveness studies. Several authors, including Kahneman, a Nobel prize in economics, have shown that human beings often violate the prescriptions of expected utility theory\textsuperscript{38}. The same violations have been documented for medical decision making by patients\textsuperscript{39}.

2. Regret-based models suggest that the choice will be based on the least amount of regret associated with a possibly wrong decision\textsuperscript{33}. It corresponds closely to the “at least do no harm” principle.

3. The dual processing model is based on the theory that there are two types of processes to make a decision, an analytical, slow and logical one; and a fast,
intuitive one, usually affect-based\textsuperscript{40}. This model would assume that the first two types of models described above are correct in their predictions under some sets of circumstances. In particular, the intuitive processes are often described as faster and requiring less mental resources, and thus being used more often.

A study using vignettes of two clinical scenarios, one on a familiar condition (treatment of pulmonary embolism) and one on a rare condition (treatment of acute myeloid leukemia), assessed which threshold model is implicitly used by physicians to make decisions\textsuperscript{40}. The procedure was based on a two-response paradigm, in which the physicians read the vignette, then gave their assessment of benefits and harms using a dual visual analog scale (DVAS), as well as their decision to treat or not. This first step is considered to elicit the fast affect-based decision process. They then received additional information, and again assessed benefits and harms and provided their decision to treat. This second round of evaluation is considered to elicit the slower, more analytical decision process. The authors found that physicians mostly used regret-based threshold for the familiar condition (pulmonary embolism), and mostly used dual processing threshold for the unfamiliar condition (acute myeloid leukemia).

Since the above study was based on vignette, the full impact of regret may have been limited for two reasons. First, the time pressure and stress were probably lower than in real clinical practice. Second, a purely theoretical decision with no real patient consequences, based on a short paper description, is less likely to elicit emotion than, for example, a patient and his family in the emergency room. Thus, it is possible than in real-life setting, physicians may be more inclined to make decision based on the regret-based model instead of the dual processing model. Indeed, a real-life setting experiment, possibly in an ecological momentary assessment (EMA) format, could greatly enhance our understanding of how the various types of threshold models predict real decisions. Such a study would require eliciting harms and benefits for several frequent conditions in which there is a decision to provide or not a treatment, obtaining the patient characteristics necessary to compute the probability of needing the treatment, recording the decisions made by the physicians, and comparing the threshold computed with the decision finally made.
Regret-driven learning algorithms

Most human learning occurs in social context and is therefore in part interactive. Actions taken by other individuals influence one’s own decisions. Laboratory studies have tried to mimic the complex interplay of decisions and consequences in real-life by games often offering only two choices. One of these choices will offer the best outcome; the other choice will offer a less positive outcome. For example, the most well known game is the prisoners’ dilemma (Table 1). In this game, the story is as follows. The two players committed a crime together and are placed in two separate rooms in a police station. A prosecutor comes and tells them: “if you confess your crime and testify against the other player, and the other player does not confess, then you will not be convicted. If you both confess, you will both go to prison for two years. If you do not confess but the other player does, you will go to prison for three years and the other will walk free. If nobody confesses, you will be charged with lighter crime and go to prison for one year.

Table 1: Payoffs in a prisoners’ dilemma game matrix

<table>
<thead>
<tr>
<th>Player 1</th>
<th>Player 2</th>
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<tbody>
<tr>
<td>Confess</td>
<td>Confess</td>
</tr>
<tr>
<td>-2; -2</td>
<td>0, -3</td>
</tr>
<tr>
<td>Does not confess</td>
<td>-3, 0</td>
</tr>
</tbody>
</table>

In this case, the payoffs in the matrix represent time in prison.

Using experimental games, studies have tried to predict the decisions taken by participants both for a single game, and for repeated games in which the participants may change strategies\(^4\). These studies rapidly showed that human behavior is not rational, and uncovered a large number of biases that actually make
human decision-making quite difficult to predict. Seminal works on the subject of decision-making come from Kahneman and Tversky\textsuperscript{42,43}, who won the Nobel Prize for their work. The prospect theory they developed aims at explaining why individuals often make decisions that seem irrational, and proposed that people tend to overweight small probability events when they make risky one-off decisions, and to underweight high probability events. They also described how individual are more influenced by losses (they try to avoid loss) than by gains, using a value function. Thus, losing $5000 seems more important than gaining $5000. The interaction between the overweighting of small probabilities and the differential values between losses and gains led to the “fourfold pattern of risk attitudes”: risk-averse behavior for moderate probability gains or low probability losses, and risk-seeking behavior for moderate probabilities losses or low probability gains.

Researchers in machine learning trying to imitate human decision-making found that prospect theory as well as other theories on cognitive biases in decision-making did not always accurately predict decisions\textsuperscript{44}. Indeed, some theories’ predictions contradicted each other. In 2008, an article in Science\textsuperscript{16} demonstrated that regret driven neural networks more accurately predicted observed human decisions in 21 experiments. The authors used one of the basic neural network models called one-layered analog perceptron\textsuperscript{45}. This model includes an input node $x_i$ corresponding to each payoff in the game matrix, the other player payoffs, and an output $y_k$ for each action that can be played by player $k$. Input information correspond to the payoff of the current game, and output node activation is calculated by a function taking into account all inputs connected to the output nodes and the values (weights) of the incoming connections. These output activation values can be seen as propensities to play a certain action (i.e., make a certain decision). The novel part of this model came from the feedback process used. Specifically, the weights between the input and output nodes were a multiplicative function of:

- the payoff saliency (i.e., the strength of the input to the node),
- the best response of player $k$ to the other players’ actions, the propensity of player $k$ to play a certain action $I$, and the regret given everyone’s actions.

More specifically, regret is implemented as the difference between the actual payoffs received by a player $k$ and the maximum possible payoff, given the other players’ actions.
- The learning rate

Compared to previous modeling approaches, the main difference is the regret component added to the error feedback. Of the 21 experiments included, the model including a regret component better predicted the decisions of the subjects of at least two-third of the experiments. More generally, modeling approaches emphasizing previous experiences as the driver of choice for future decisions have enhanced decision-making models. In lay terms, the proverb “we learn from our mistakes” may be incomplete, it may be more accurate to say “we learn from the mistakes we regret”.

Patients’ regrets following important medical decisions

Patients are now encouraged to be involved in decision making about their own health care. However, difficult decisions, especially those with no clear preferable clinical option, can lead to regret. Regret is increasingly considered an important patient-reported outcome (PRO). A recent systematic review found 59 studies measuring patients’ regret. In this review, most studies focused on patients with breast cancer or with prostate cancer (66%). On a scale of 0 to 100, the pooled mean intensity of decision regret was 16.5. However, these means varied from 2.5 to 49.1, with the highest regret measured in a sample of breast cancer patients making decisions on fertility treatments. Regret was higher in studies measuring regret 6 months or more after the decision, and in studies investigating treatment decisions versus other types of decisions such as diagnostic. In studies using a cutoff to distinguish lower and higher levels of regret, the prevalence of high regret (cutoff at 25) following an important healthcare decision varied between 4% and 20%.

In this field of research focusing on patients’ regret, regret is usually seen as a negative emotion, and risk factors for experiencing regret are examined with the goal to determine how regret can be minimized. These risk factors can be categorized into patient characteristics, decision-making process characteristics, and treatment-related characteristics. In the previously cited review of patients’ regret, among patient characteristics, high regret was associated with anxiety and
poor coping skills but not with socio-demographics including age, education, or ethnicity. Among decision-making process characteristics, regret was associated with high decisional conflict and low patients’ satisfaction with the information they were provided. Finally, among treatment-related risk factors, the most prominent were post-treatment complications and adverse outcomes. All these risk factors were described as modifiable, non-modifiable or potentially modifiable, with the discussion focusing on how to “prevent decision regret” (p. 784), potentially through reducing decisional conflict. For instance, decision aids developed to support patient involvement and participation has been shown to be beneficial in terms of increasing satisfaction, and reducing decisional conflict, and anxiety.

Interestingly, a decision making study focusing on patients at the end of life choosing between hospice versus curative / life-prolonging treatment showed that a regret-based model better predicted the actual choices made by patients. In this study, the patient preferences were elicited using dual visual analog scale of regret of omission (regret to continue to receive unnecessary treatment), and regret of commission (regret of being referred to hospice instead of continuing to receive life-prolonging treatment). The threshold model postulates that there is a probability of death (pD), such that, if pD is higher than the threshold, the patient should choose hospice care, and if it is lower, the patient should choose life-prolonging treatment. In this study, the probability of death was computed using the palliative performance scale (PPS), and the threshold (T) was computed as:

\[
T = \frac{1}{1 + \frac{R_{\text{omission}}}{R_{\text{commission}}}}.
\]

*Equation is published in.*

where \( R_{\text{omission}} \) is the visual analog scale score associated with regret of omission and \( R_{\text{commission}} \) is the scale associated with regret of commission.

The procedure was in five sequential steps:

1. Contact the patient,
2. Elicit regret of omission and commission using the two DVAS,
3. Ask about his or her choice (hospice vs. life-prolonging).
4. Only then did the investigator provide a recommendation based on the patient preferences and his or her probability of death.

5. At the end of the discussion, the patient indicated his or her agreement with the recommendation.

The final choice of the patient was also recorded. The findings of this study are that patients were often in agreement with the recommendation, with 85% of the 178 patients in agreement and 15% unsure about their decision. None disagreed directly with the recommendation. However, at the end, only 72% (N=112) of patients actually decided in agreement with the recommendation. Post-decisional regret in the following months was overall lower for patients choosing hospice versus life-prolonging treatment.

**Combining theories on regret**

Theories on anticipated regret and learning algorithms are quite congruent, both positing that experiencing regret will help modify future decisions. However, there are also differences in how these two fields interpret the usefulness of regret. The literature on anticipated regret focus more on how regret-driven modifications of future decisions can alter rationality and lead to inappropriate decisions (e.g., excessive testing, when the test will not be informative). In contrast, learning algorithms show that adapting decisions, based on previous results that were regretted, is an efficient strategy.

Compared to the congruence of anticipated regret and learning algorithms theories, there is a dramatic discrepancy between these latter theories, viewing regret as a drive to modify future actions, and the literature on patient’ regret viewing regret as a negative emotion that should be avoided as much as possible. This discrepancy may be due to the fact that patients’ regret are supposed to be due to rare or unique events (e.g., deciding to undergo a complete mastectomy) and thus learning derived from this single event may not help with a future, similar decision. However, this lack of future events may not hold true for patients with chronic disease. It will also not hold true for healthcare professionals, who, due to
their profession, will regularly make decisions or perform acts that will have severe consequences (e.g., decide on advising complete mastectomy to a patient, perform a painful procedure). Thus, there is a need to combine the various fields of research described above taking into account the specificity of the healthcare profession, and the frequent, repeated, and often momentous, nature of the decisions and actions they need to do.

**Impact of care-related regret on healthcare professionals**

Based on the literature presented above, and our own studies, we have developed a framework to model the process of feeling regret, how these feelings and the associated coping can be characterized as exposure and the potential consequences of these exposures.

First, regret follows a decision or action, or the absence of a decision or action (i.e., regret of commission and regret of omission). The situation eliciting the regret can have consequences for the patient or not. For instance, a surgeon preparing to operate on the wrong side but stopped in time during the initial check can feel regret even though the patient did not suffer any ill effect and indeed may not even be aware of what happened. The healthcare professionals will feel a certain intensity of regret and will cope with this feeling.

Considering regret as an exposure, similarly to smoking for example, requires careful reflections, and deciding how to model this exposure correctly becomes a key issue. Based on the qualitative study presented thereafter, we found that healthcare professionals mostly report regret as the intensity of very strong regrets (i.e., the few events that shaped their career, such as operating the wrong patient or not detecting that a patient would commit suicide), the accumulation of small regrets, and the set of coping strategies used. While these three aspects of regret exposure emerged from the qualitative study, how these aspects combine is difficult to predict. In studies of emotions, the same stimulus, with a specific intensity, can be presented with a given frequency of presentation. The impact of the emotional stimulus’ intensity and frequency are sometimes similar, and a more parsimonious model of exposure can be to combine intensity and frequency. In contrast,
researches on real-life situations, focusing on happiness\textsuperscript{54} or depression\textsuperscript{55}, found a different impact of frequency and intensity of emotions. Future researches will determine whether the model can be simplified while remaining accurate.

Regret now expressed as an exposure defined as having three components (highest regret intensity, accumulation of regrets and coping strategies) has a wide range of consequences on three levels (Figure 1, outcomes)\textsuperscript{56}. First, regret influences physical and mental health at the individual level. The intensity of regret is associated with feelings of loss\textsuperscript{57} and with a wide range of physical and psychological symptoms\textsuperscript{58}. Regret also disturbs sleep\textsuperscript{17,18,59}. Given that sleep loss may lead to attention deficits\textsuperscript{60} and thus to an increased risk of errors and regretted decisions\textsuperscript{61}, a vicious circle between errors, regrets, and insomnia could emerge\textsuperscript{62}. Second, based on literature on anticipated regret, but also on learning algorithms, we can hypothesize that regret may influence clinical decision-making, either at the individual level, through learning, at the patient care level, through changing practice in the ward (e.g., rigorously applying identity bracelet checking), or at a more global level, through the diffusion of new guidelines. Finally, intense regrets decrease job satisfaction\textsuperscript{63} and may lead to more sick leave, and eventually to the decision to change jobs (Figure 1).
The articles included in this privat-docent thesis explore and support various aspects of the theoretical framework presented above. The first article presented is a qualitative study of 25 healthcare professionals (nurses and physicians) exploring the situations which elicited regret, the strategies used to cope with the regret, and how these regrets decreased over time, as well as the consequences felt by the healthcare professionals. The second and third articles describe the validation of two scales, one of regret intensity and one of regret coping, in a Swiss-French and Swiss-German sample, providing two validated scales in French and in German. The fourth and fifth publications examine the association between regret and the hypothesized outcomes, with the fourth article focusing on sleep problems, and the fifth article examining sick leave. A final publication, which is a letter published in the Lancet, aims at raising awareness on the subject of regret, with the goal of encouraging hospital leaders to implement trainings on regret coping.
The first incentive to start a research program on regret was based on anecdotes, told by nurses or physicians, on difficult situations they had encountered while providing healthcare. The emotional burden and the strategies used to deal with these emotions seemed not very formalized and, while many talked about decision making, none evoked the idea of regret after a decision. The goal of this first study was to qualitatively investigate which situations most elicited regret, which strategies were most often used to cope with these regrets, and what consequences these regrets and coping strategies had on the healthcare professionals. A secondary goal was to see if regret was indeed an important emotion among healthcare professionals according to the healthcare professionals’ themselves. This research received a grant from the “Bureau Qualité” of the HUG in 2009.

With respect to the situations eliciting regret, an interesting finding was that the situations eliciting regrets were not necessarily mistakes. Indeed, regrets after participating in a medical error were as intense as regrets after an event that was not a medical error. The situations were also very diverse, and did not necessarily cause harm to the patient, though the emotions felt by the healthcare professionals were often quite similar.

Below are some examples of situations reported by the participants as causing their most intense regrets (a more complete list is provided in Appendix 1):

<table>
<thead>
<tr>
<th>Events classified by a physician as medical error or at least mistakes</th>
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<td>Physicians</td>
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- A house officer treating a patient with a metatarsal fracture gave non-steroidal anti-inflammatory drug to avoid deep venous thrombosis. Ten days later, the patient was readmitted for a massive pulmonary embolism. The patient responded well to treatment. The house officer later learned that he should have given anti-coagulants instead.

- An obstetrician, thinking out loud, inadvertently informed the parents about the sex of their expected twins. Parents were shocked and told her that they did not want to know.

**Nurses**

- A nurse put the vaginal probe used to examine an HIV+ patient in a common cleaning tub for all probes. She immediately discarded all probes and phoned a colleague working with HIV patients. Her colleague told her that there was no significant risk of infection.

- A nurse entered a room to administer insulin to a patient and called her name. One of the two patients present said yes and the other did not react, so the nurse gave the insulin dose to the first patient. Thirty minutes later, the nurse realized that she gave the insulin to the wrong patient. There were no consequences.

**Events classified by a physician as not medical error or mistakes**

**Physicians**

- A drug user patient was treated for pneumonia without significant improvement. The house officer in charge wanted to perform additional tests but her chief disagreed. She regretted not standing up to her chief and wondered if the patient had side-effects due to delaying the more appropriate treatment.

- A patient with a chronic disease did not take his treatment regularly, thus considerably reducing its effectiveness and potentially inducing resistance. Hoping to change his behaviour, a physician talked harshly to him. The patient broke contact.

**Nurses**

- A patient in a medical ward, who was supposed to receive only palliative care, was still examined regularly. The nurse had to take blood samples every two hours
and temperature every 30 minutes. The patient died one hour after the last blood tests.

- A nurse was attending to a 40-year-old patient with terminal cancer in much pain. The nurse thought that she would probably die during the night, but felt incapable of seeing her because it was “emotionally unbearable”. She asked a colleague to go and see her in her place, but her colleague answered that she was too busy. The patient died alone during the night.

The interviews showed that regret, though rarely called under that name by the healthcare professionals, was an important facet of their emotional experience at work. Since regrets can occur after a decision or action (or the absence of such a decision or action), jobs that require many decisions and actions will create more opportunities for regret.

Note that two additional qualitative studies following the same methods (i.e., same sample selection in hospitals’ healthcare professionals, same interview guide) are ongoing in Zürich (manuscript in preparation), and in the US. The goal is to compare regret and regret coping across different cultures.

While this study provided many insights on regret and how healthcare professionals felt, the qualitative design had some disadvantages. In particular, the sample was not representative of healthcare professionals in general, and the strength of the associations found could not be estimated.

(Appendix 2)

The previous research showed that regret was indeed a relevant construct for some healthcare professionals, and unearthed a large array of potential consequences of regret. Thus, the next step was to examine the consequences described by healthcare professionals, such as sleep loss and change in practice in a more representative sample, through a cross-sectional survey. However, a thorough search of the literature did not yield any scale that focused on regret associated with providing healthcare. For instance, scales assessing coping were all focused on emotion regulation in general and not specifically on regret. Furthermore, these scales were not validated among healthcare professionals. The most pertinent scales were the ways of Coping Inventory-Revised (WOC-R), the cognitive emotion regulation questionnaire (CERQ), the coping strategies index (CSI), and the COPE inventory (Table 2). However, all scales were relatively long (>30 items). While we needed a scale assessing problem-focused and emotion-focused strategies, the CERQ focused only on the emotion-focused strategies that concerned cognitive aspects (9 strategies are assessed). The WOC-R and the CSI were made to assess the coping of a single, intense, situation, whereas we were interested in the overall coping style. In contrast, we wanted a scale for regret regulation, and assessing the overall frequencies of coping strategies for all regrets related to providing healthcare. While the COPE technically fit our requirement, it assessed 15 dimensions and could not be used to compute a few summary scores (e.g., one score for problem-focused strategies, one for emotion-focused).
Table 2: Characteristics of existing scales (personal contribution)

<table>
<thead>
<tr>
<th></th>
<th>WOC-R</th>
<th>CERQ</th>
<th>CSI</th>
<th>COPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of items</td>
<td>66</td>
<td>36</td>
<td>33</td>
<td>60</td>
</tr>
<tr>
<td>Number of dimensions</td>
<td>3</td>
<td>9</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Situation-specific</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Assess all strategies*</td>
<td>PF, EF, SSS</td>
<td>EF</td>
<td>PF, EF, SSS</td>
<td>PF, EF, SSS</td>
</tr>
<tr>
<td>Reliabilities provided</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* PF: problem-focused strategies, EF: emotion-focused strategies, SSS: seeking social support strategies

Thus, our next step became creating two new scales: a regret intensity scale, assessing the current intensity of the regret that was the most intense in the last five year, and a regret coping strategies scale, assessing the frequency of various types of strategies. This study was supported by a grant from the “projet recherche et développement” of the HUG in 2010.

Creating a scale is a difficult endeavor because it requires a careful generation of the scales’ items, and a pretest of these items among future respondents. Indeed, we generated 30 items, and 11 were immediately detected as inappropriate by a panel of healthcare professionals (14 nurses, 5 physicians). Creating a reliable, valid, and short scale also requires advanced statistics to detect the most informative items, and thus avoid lengthy scales. Because of this lengthy process, that we needed to describe in sufficient details, the regret intensity scale and the regret coping scale were validated in a separate article. Here, I only present the validation of the regret intensity scale (for the regret coping strategies scale, see 64).

(Appendix 3)

The initial survey in the HUG showed promises that regret did have consequences at the individual and institutional level. It also had an unexpected result. Our first survey was sent with a coded number, and we then followed-up with three reminders. The healthcare professionals were informed that they could indicate that they did not want to answer by sending back an empty questionnaire. We then used the coded number to stop sending reminder to these persons. Most surveys use this procedure and around 2% of people contacted use this opportunity. In this survey however, 22% returned an empty questionnaire. Several respondents wrote on the questionnaire that they had no regret. Since theories on emotion consider regret as a normal part of a human being’s psyche, such answers were surprising. Indeed, it is a bit similar to someone saying that he has no left arm.

The aim of our next study was then two-fold. First, we wanted to validate the scales in German, in order to facilitate a larger project aiming at studying regret at the national level. A second aim was to see if we still had a large group of people indicating they had no regret, and to investigate the most frequent consequences of regret: sleep problems. Possibly, the healthcare professionals stating that they had no regrets were instead using a coping strategy called suppression, by which people suppress their emotion, often for a relatively short period of time. This strategy has been shown as often ineffective in the long run or even toxic. As expected, we found that healthcare professionals reporting no regret had significantly more sick leave in the last months, and had more, albeit not significantly, sleep problems.

Note 1: This study was used by Dr. Richner (first author) to obtain her MD.

Note 2: The scales are currently being validated in English, by our own team. They are also being validated in Danish, and Chinese by two teams who contacted me to ask permission to use the scales.
This study focused on consequences of regret at the individual healthcare professionals’ levels. Sleep problems are a well-known issue among healthcare professionals, and both night shifts and emotional states have often been proposed as the main reasons for these problems. Several studies using self-report questionnaires found that around 70% of nurses and 70% of physicians with burnout reported poor sleep. Using DSM-IV criteria, the prevalence of insomnia among physicians was 18.8%.

The most worrying finding in this study is the strong dose response association between maladaptive regret coping and reported use of sleeping pills. The proportion of healthcare professionals reporting sleeping pill use more than once a month was less than 10% for the participants reporting very rare use of maladaptive strategies compared to >60% for participants reporting very frequent use of maladaptive strategies. This association was also present for regret intensity, but sleeping pill use only increased for very high level of intensity.

A limitation of this study is the use of self-rated questionnaire for regret and for sleep problems. This may artificially inflate the association between them due to self-reporting bias. Thus, it is important to replicate these findings using objective measures of sleep, for instance using actimeters (cf. discussion).

(Appendix 5)

This study explored the associations between regret and healthcare professionals’ health, including sick leave. Healthcare professionals’ health is important at the individual level, as it is a facet of quality of life. However, it is also important at the institutional and patient care levels because absent or unhealthy physicians and nurses cannot provide good and safe care69,70. Specifically, lower health, when culminating in increased sick day leaves, has three consequences:

1. Absenteeism will cause extra work for the remaining, present, healthcare professionals when there are no replacement,

2. Even when absent healthcare professionals are replaced, patient safety may be lower because replacement personnel are often less knowledgeable about the specifics of the units (e.g., where is the resuscitation tray), though this association between replacement staff and quality of care is controversial71,72.

3. Absenteeism also represents a financial cost for the institution not only in terms of paying the extra hours for the replacement, but also because it requires a larger pool of potentially available healthcare professionals73.

A limitation of this study is again the use of self-rated questionnaire for regret and for health measures, including sick leave. This may lead to information bias since healthcare professionals may be prone to underreport their sick leave days, and this underreporting could differ by levels of regret. Thus again, it would be useful to replicate these findings using objective measures of sick days, by involving the human resources department of the hospitals and obtaining objective days missed. This future study will require a careful attention to ethical aspects, since absenteeism is often stigmatized. In particular, creating a fully anonymized survey may be necessary.
To summarize, previous evidence has shown that regret intensity and regret coping are associated with one’s own wellbeing, but also with learning and, through this change in learning, with changes in patient care. These results should promote the creation of trainings to increase emotional awareness and improve use of coping strategies. Indeed, John Hopkins hospitals have implemented with good results the Resilience in stressful events (RISE) second victim support program. However, these programs are still rare and often do not reach most healthcare professionals who could need it due to their relatively small scale. Indeed, healthcare professionals already receive many trainings and their time is precious. It is thus important to publish letters and opinions about regret in particular and emotional burden in general to make faculty and hospitals’ supervisors aware of this issue and obtain their support for the creation of such training.

The aim of this letter, published in the Lancet, was to raise awareness of the job-related emotional burden faced by some healthcare professionals. Indeed, following the publication, a few healthcare professionals as well as one chaplain from various hospitals around the world contacted me.
Conclusions and future perspectives

Since the sixth article, presented above, is already a summary and a temporary conclusion on the previous work, I will focus directly to future perspectives. As discussed before, qualitative and cross-sectional quantitative surveys support the idea that regret is a relevant concern for healthcare professionals. Future studies, however, are needed to determine whether the impact of regret is causal, and whether we could act on regret and regret coping to reduce negative and favor positive consequences. Obtaining an answer to the question of causality requires at least a longitudinal design with a relatively large cohort of healthcare professionals. Then, when (if) the causality is better established, obtaining an answer to the question of being able to modify regret coping requires a randomized controlled trial. Indeed, it is necessary to determine whether an intervention could help reduce the emotional burden on the healthcare professionals, and, by doing so, reduce the negative impact of regrets, such as sleep problems, increase in sick day leaves, and loss of job satisfaction. In this section, I discuss three studies that aim at assessing causality and estimating the effectiveness of a training to improve regret coping.

The first one is a cohort study of novice healthcare professionals. The second study is a theoretical cost-effectiveness study to assess the maximum amount of money that a training to improve regret coping could cost and still be cost-effective. In this study, I assumed a small effect of the training. Finally, a third study is proposed to assess this effect of training using a randomized control trial to avoid the confusion biases that were inherent to all the previous, observational, studies.

Cohort study of healthcare professionals

Note that the study described below is currently ongoing after being funded by a Swiss National Science Foundation project grant.

Assessing causality in an observational study is very difficult. But at the minimum, it requires that the exposure occurs before the outcome, and that potential
confounding variables were assessed and controlled. The study described here attempts to meet these requirements by investigating regret and regret regulation as they occur in an ecological momentary assessment (EMA) study of novice doctors and nurses. To minimize forgetting and memory biases, data will be collected at short time lag intervals (each week) using an Internet-based survey. This data collection method will help capture the real-time impact of regret among healthcare professionals. Moreover, this approach will allow us to study in detail which regret regulation strategies are used in specific situations and whether they are helpful or not. Another advantage of this method of data collection is that subjects feel more comfortable reporting higher level of distress and feelings such as guilt, shame, humiliation or anger when they are using automated systems. However, such a frequent data collection requires the survey to be short, to avoid response fatigue. One solution to shorten the survey is to limit the number of outcomes investigated. Thus, we will keep only two main outcomes: sleep problems and job quitting. Sleep problems are a very important issue for healthcare professionals because work characteristics (e.g., shift work) already have a detrimental impact on sleep, especially among residents doctors. Furthermore, sleep problems increase the risk of medical error. Career abandonment is also of particular interest since the costs of training doctors and nurses are considerable, i.e. a loss of >5% of the total annual operating budget. Indeed, the high turnover of nurses may partly result from a pattern of regret-inducing events that overwhelms the existing regret regulation strategies available to this person.

Methods

To examine the causal impact of regret frequency, highest intensity, and coping strategies on sleep problems and job quitting, we will use a prospective longitudinal study of newly practicing nurses and medical doctors. We selected novice nurses and medical doctors because young age is a significant factor of turnover intentions. Moreover, young clinicians are at higher risk of regretted decisions and actions as they are still learning skills to do their job. Finally, our qualitative study suggested that many clinicians described intense experiences that dated back to their first years of clinical practice. Individuals who already provided healthcare in a professional capacity (i.e. excluding internships) are excluded.
Students in nursing and medical studies will be recruited during their last year of training (i.e., Third year of the University of Health Sciences for nurses, and sixth year of the Faculty of Medicine for doctors) in a random sample of schools from French- and German-speaking countries. Compensation for the study will consist of a donation to charity of 0.5chf or euro per survey clicked (a reward before survey completion should increase response rate\(^{63}\)). The Theodora foundation (Giggle doctors for children: http://ch.theodora.org) was already the receiving charity for the pilot study and will continue to be for this larger project.

**Design:** 3-year ecological momentary assessment study with one measure per week for one year. Then a follow-up every 6 months in year 2 to 3 to obtain longer-term information on job quitting. The survey will be administered using Limesurvey. This software is installed on a secure server, and is already provided by the University of Geneva. Participants will be sent the survey on Monday afternoon and, if they do not answer, will receive up to two reminders per week, on Wednesday and Friday.

**Sample size:** the estimates are based on expected number of career change among nurses (18% over 3 years)\(^5\). We have 5 regret variables (number, intensity, 3 coping strategies). Current guidelines on sample size for predictive models require a minimum of 5 events (i.e. turnover in this study) per predictor (i.e. the 5 regret variables in this study), yielding a minimum of 25 necessary events.\(^{84}\) We expect a loss to follow-up of 10%. Thus, we need a minimum of 153 nurses (25 events divided by 0.18(incidence of turnover) times 1.1 (to compensate 10% loss to follow-up). An additional 47 nurses will be recruited to allow for a potential lower incidence of turnover and the potential inclusion of covariates in the model.

For medical doctors, turnover rates are much lower and are also less documented. For this reason, sample size calculations are based on the sleep outcome, and more specifically on sleeping pill use. In our cross-sectional study, the use of sleeping pill was 14.3% among medical doctors younger than 30 years old\(^59\). Thus, the same sample size of 200 is necessary.

**Measures:** Table 3 summarizes the measures taken in Year 1, with which instrument, and at which frequency. The first survey will also collect sociodemographics and personality data, including anxiety and depression. Each weekly survey (65 questions) should take maximum 10 minutes.
### Table 3: Measures in Year 1 of the prospective study (Personal contribution)

<table>
<thead>
<tr>
<th>Measure</th>
<th>N items</th>
<th>Frequency of measurement</th>
<th>Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most intense care-related regret overall</td>
<td>10</td>
<td>Variable (1x-52x): only if at least one regret, else skip</td>
<td>RIS-10&lt;sup&gt;85&lt;/sup&gt;</td>
</tr>
<tr>
<td>Number of regrets in the last week</td>
<td>1 + 10</td>
<td>52x: first question is a filter, skip if no regret this week. 9 questions to describe event and regret intensity</td>
<td></td>
</tr>
<tr>
<td>Regret coping in the last week</td>
<td>15</td>
<td>52x</td>
<td>RCS-HCP&lt;sup&gt;64&lt;/sup&gt;</td>
</tr>
<tr>
<td>Change of practice in the last week</td>
<td>1</td>
<td>52x</td>
<td></td>
</tr>
<tr>
<td>Satisfaction with work in the last week</td>
<td>5</td>
<td>52x</td>
<td>GSWW&lt;sup&gt;86&lt;/sup&gt;</td>
</tr>
<tr>
<td>Number of work hours, night shifts, and sick days in the last week</td>
<td>3</td>
<td>52x</td>
<td></td>
</tr>
<tr>
<td>Safety climate in the unit</td>
<td></td>
<td></td>
<td>SAQ&lt;sup&gt;87&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sleep, incl. dreams and pill use, in the last week</td>
<td>9</td>
<td>52x</td>
<td>ISI&lt;sup&gt;88&lt;/sup&gt;, 2 items from PSQI</td>
</tr>
<tr>
<td>Intention to change profession</td>
<td>1</td>
<td>12x (monthly)</td>
<td></td>
</tr>
<tr>
<td>Back pain</td>
<td>2</td>
<td>12x (monthly)</td>
<td></td>
</tr>
</tbody>
</table>

Note: RIS-10: regret intensity scale; RCS-15: regret coping scale; GSWW: Global Satisfaction with Work (Echelle de satisfaction globale au travail); ISI: insomnia severity index; PSQI: Pittsburgh Sleep Quality Index

In addition, each 6 months over the remaining two years of the study, the survey will measure quality of life using the EuroQol 5-dimensions (EQ-5D), health status using the SF-36, sleep using the insomnia severity index (ISI) and 2 questions from the Pittsburgh Sleep Quality Index (PSQI) on dreams and pill use, burnout using the Maslach Burnout Inventory (MBI), and professional status (i.e., whether caregivers still work with patients). These surveys should take less than 30 minutes.

Finally, to verify the quality of the self-report on sleep quality using the insomnia severity index and the two questions from the PSQI, we will use a small subsample of nurses and physicians and ask them to wear actimeters during their sleep for 6
weeks. We already have 8 actimeters available. Note that this study already has ethics committee approval and recruitment is ongoing with 20 healthcare professionals already included.

**Analysis:** We will use survival analysis to examine the impact of the five regret variables (frequency, highest intensity, and coping strategies) on job quitting. This analysis will be done separately by profession. Since regret is an exposure, which varies over time, several ways of characterizing this exposure will be tried (e.g., maximum intensity of regret, or area under the curve of maladaptive coping). In addition, we will also examine the possibility to characterize individuals as having efficient versus inefficient coping skills using cluster analysis. We will then determine if people with inefficient coping are more at risk of job quitting or sleep problems.

With respect to the sleep outcomes, the analysis is more complex since regret intensity will influence regret coping, and both should have a causal impact on sleep. At the same time, sleep problems is known to worsen mood regulation. Thus, the causal process is quite complex and will require careful statistical modeling. We will examine the association between regret and sleep during the same week using linear mixed models (also called multilevel model). Furthermore, we will examine the causal association between regret one week earlier (w-1) and sleep during week w using the same type of models. These analyses with a lagged exposure are related to Granger causality.\(^8^9\) Note that Granger causality is relatively weak since it does not exclude the possibility of a confounding variable acting first on regret and then on sleep.

However, regret intensity and regret regulation unfold over time in a complex pattern, following events that occur at varying intervals. Furthermore, their consequences, for instance on sleep, may then in turn impact regret regulation, since sleep is known to impair emotion regulation\(^6^2,^9^0\), leading to a circular causality\(^9^1\). Thus, modeling the results of this prospective study may require the development of new statistical models, which will also be of interest to other researchers, in particular for cohort studies and ecological momentary assessment studies. While describing the models is beyond the scope of this privat-docent, the overall reasoning is exposed below.

Generally, modern longitudinal studies have become more intensive, often producing 10 or more measurements per subject. These intensive longitudinal data
(ILD)\textsuperscript{92} stem from long cohort studies such as the Framingham cohort\textsuperscript{93}, or the Swiss HIV cohort\textsuperscript{94}, but also from the use of electronic devices (e.g. online monitoring, PDA or cell phone reporting)\textsuperscript{95} or the use of electronic medical records. Following the emergence of these data, researchers have been able to examine change in specific states over long time periods.\textsuperscript{96,97} For instance, Freedman et al.\textsuperscript{98} studied trends in disabilities and functioning while, in a completely different context, Gauderman et al.\textsuperscript{99} studied lung development. Alternatively, some studies examined recurring cycles and patterns, such as the stability of the circadian temperature rhythm\textsuperscript{100} or the patterns of cigarette smoking events over several weeks.\textsuperscript{101} Given the increased use of intensive longitudinal designs, new statistical models appropriate to these data are needed for applied researchers. Aided by such new models, researchers could examine the dynamical unfolding of events (e.g., alcohol drinking) with their consequences over time (e.g., liver function). Thus, while the development of a model for unfolding events over time will be necessary for this study, it will also be very useful for other researchers.

To examine the interplay between events (e.g., regret-inducing events) and their consequences (e.g., regret intensity, sleep problems, job quitting), both patterns of events and their consequences must be modeled. Point process models can estimate patterns of events, and differential equation modeling can model the cycles in the consequences of these events. However, separately, these models do not capture the interplay between patterns of events and their consequences. Thus, we will develop a combination of these models.

**Point process models**, potentially including time varying covariates, can examine the rates of events (i.e., regret-eliciting events), expressed in units of numbers of events (N) per unit time.\textsuperscript{102,103} The most well-known point process model is the Poisson model. Point process models can be used to determine if the patterns of occurrence follow a specific type of process, such as self-exciting process (i.e. the occurrence of an event increases the probability of another event occurring), or stress release point process (i.e. probability of event increases when a covariate reaches a certain threshold).\textsuperscript{101} Parameters from the point process models could then be included in the differential equation.

The feelings of regret can be modeled using a specific type of **differential equation models** (related to state space modeling) that predicts not the outcome itself but its
first or second order derivative with respect to time.\textsuperscript{104,105} The first derivative expresses
the speed at which the outcome changes and the second derivative expresses how
the outcome accelerates. Thus, differential equation models can allow one to
model the association between a person’s current state and how this state changes
over time. Within this large framework of models, the damped linear oscillator\textsuperscript{106} is
particularly useful to model regulated systems, i.e. systems that temper outside
influences (regret-inducing events) to go back to some equilibrium, but not
necessarily to the same level\textsuperscript{107} (Figure 2). The shape of damped linear oscillators
depends on the frequency parameter (related to duration of a cycle), and the
damping parameter (how quickly they will return to their initial state, in the case of
human emotions, this would be called resilience).

Figure 2: 1-year trajectory of regret intensity after regret-inducing events (damped
system). (Personal contribution)

Since individuals are not perfect damped linear oscillators, the physical model
above must be extended to a statistical model accounting for interindividual and
intraindividual variability and outside influences. First, an error term can be added to
account for unknown outside influences. Second, generalized linear mixed model (GLMM) or latent variable models can be used to model the variation across individual in cycle’s duration and the speed of the damping. For example, some individuals may recover from a regret-inducing event faster than others.

Additional developments are needed to combine events and their consequences (e.g., regret intensity, sleep). For instance, the damping parameter could be moderated or mediated by covariates, if data are available on the strategies healthcare professionals use to deal with the events.

**Cost-effectiveness study: in which conditions would a training be worthwhile?**

A key reason to explore regret in health care concerns its influence on the physical and mental health of care providers, with potential impact on patients’ outcomes. Briefly, previous works suggests that regret is associated

1. with sleep disorders and attention deficits thereby potentially increasing the risk of errors.
2. with anxiety.
3. with more sick leaves, and lower job satisfaction, which could potentially lead to more turnover.
4. with learning and thus potentially with patient care.

Assuming that these associations reflect the causal impact of regret on these negative consequences on healthcare professionals, there is still a need to know whether an intervention could moderate these consequences at a reasonable cost. In this chapter, I present a cost-effectiveness study with the aim to evaluate the potential impact of providing training in regret coping on costs and on effectiveness as measured by quality adjusted life years of practicing physicians. Due to a lack of information, I exclude the impact on patient care. This study will also allow
estimating the maximum cost of the training that would still increase cost-effectiveness.

**Methods**

The target population was physicians providing healthcare in hospitals. A decision model was developed to evaluate and compare the two strategies (training vs. no training) using TreeAge Pro, 2013; TreeAge, Williamstown, MA). The Markov model had a cycle length of 1 week and was run for 10 years (520 cycles).

**Markov model**

Physicians could cycle through four different states (Figure 3): a) well; b) regret > 5 (on a scale from 0 to 10); c) recovery from regret; and d) out of healthcare providing workforce. The ‘out’ state was an absorbing state. In all other states, during each one-week cycle, they could experience regret, go out of the workforce or not experience regret. Additionally, in the ‘recovery’ state, if they did not experience regret for 4 consecutive cycles, they returned to the well state with the number of regrets decreased by one (Figure 4). Finally, for each cycle, there was a probability of experiencing anxiety problems, sleep problems, or both.

Figure 3: states and potential paths through the states (Personal contribution)
Data sources and assumptions

The probabilities, costs and utilities for this model came from 4 different sources:

1. Data from a cross-sectional survey (n=220 physicians) with information about regret intensity during the last month, number of regrets during the last month, sleep problems (insomnia severity index), sick day leaves during the last 6 months.
2. Article from Buddeberg-Fischer (2005) indicates that 4 out of 719 new medical doctors went out of the medical workforce over a two-year period.
3. Survey of 19 physicians following a course on decision analysis in Harvard provided the utilities (time trade off for a 1 week duration) of having anxiety problems, having sleep problems, and having both.
4. Costs were based on guestimates of loss of productivity during sick day leaves, cost of training physicians (5 or 6 years of medical school) and cost of regret coping training.

Assumptions were used to determine the remaining parameter estimates, namely the parameters that concern the effect of training on the consequences of regret, the probability of quitting the workforce given that the physician experienced or did not experience regret, and the number of cycle in the recovery state needed to go back to the well state. Furthermore, I assumed that the probability of having anxiety problems was identical to the probability of having sleep problems (literature gave probability of 30% at any given time, which seemed excessively high). These data sources and assumptions provided parameter estimates for the Markov model (Table 4).

Table 4: Parameters estimates, and data sources. All probabilities are weekly probabilities. Sources: 1) data from cross-sectional survey, University Hospitals of Geneva; 2) Article from Buddeberg-Fischer (2005) on Swiss physicians; 3) survey of 19 physicians; 4) guestimates. (Personal contribution)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Point estimate</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability experiencing a regret</td>
<td>0.0243</td>
<td>1</td>
</tr>
<tr>
<td>Probability sleep problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No regret</td>
<td>0.0417</td>
<td>1</td>
</tr>
<tr>
<td>Regret</td>
<td>0.0846</td>
<td>1</td>
</tr>
<tr>
<td>Regret and training</td>
<td>0.06</td>
<td>4</td>
</tr>
<tr>
<td>Probability anxiety problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No regret</td>
<td>0.0417</td>
<td>1</td>
</tr>
<tr>
<td>Regret</td>
<td>0.0846</td>
<td>1</td>
</tr>
<tr>
<td>Regret and training</td>
<td>0.06</td>
<td>4</td>
</tr>
<tr>
<td>Probability being sick</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 regret</td>
<td>0.0083</td>
<td>1</td>
</tr>
<tr>
<td>1 regret</td>
<td>0.0094</td>
<td>1</td>
</tr>
<tr>
<td>2 regrets</td>
<td>0.0179</td>
<td>1</td>
</tr>
<tr>
<td>3 regrets</td>
<td>0.0205</td>
<td>1</td>
</tr>
<tr>
<td>Regret Level</td>
<td>Probability</td>
<td>Training Cost CHF</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>&gt;3 regrets</td>
<td>0.0263</td>
<td>1</td>
</tr>
<tr>
<td>1 regret &amp; training</td>
<td>0.009</td>
<td>4</td>
</tr>
<tr>
<td>2 regrets &amp; training</td>
<td>0.015</td>
<td>4</td>
</tr>
<tr>
<td>3 regrets &amp; training</td>
<td>0.016</td>
<td>4</td>
</tr>
<tr>
<td>&gt;3 regrets &amp; training</td>
<td>0.17</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probability out the workforce</th>
<th>No regret</th>
<th>0</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regret</td>
<td>0.0026</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Regret &amp; training</td>
<td>0.0016</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Utility</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of anxiety</td>
<td>0.5873</td>
<td>3</td>
</tr>
<tr>
<td>Probability of sleep</td>
<td>0.6071</td>
<td>3</td>
</tr>
<tr>
<td>Probability of sleep and</td>
<td>0.3832</td>
<td>3</td>
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<tr>
<td>anxiety problems</td>
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<table>
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<th>Cost</th>
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<tbody>
<tr>
<td>Cost of being sick</td>
<td>CHF 640</td>
<td>4</td>
</tr>
<tr>
<td>Cost of regret-coping training</td>
<td>CHF 840</td>
<td>4</td>
</tr>
<tr>
<td>Cost of going out the workforce</td>
<td>CHF 100,000</td>
<td>4</td>
</tr>
</tbody>
</table>

**Data analysis**

Analyses were done with microsimulations. Training versus no training strategies were compared using costs, effects [in quality-adjusted medical work-life-years [QAMWLYs]], and cost-effectiveness ratio. All 10,000 cases (i.e., physicians) were considered identical at the start of the Markov simulation. I used a discount rate of 3% and a willingness to pay of CHF 20,000. This model includes productivity loss, since it is at the heart of the turnover problem.

The impact of the cost of training on the choice of strategy (no training versus training) was evaluated by a 1-way sensitivity analysis as well as a probabilistic sensitivity analysis of cost of training, cost of quitting workforce and probability of experiencing a regret. The 1-way sensitivity analysis varied cost of training from CHF 840 to CHF 7000. The probabilistic sensitivity analysis sampled cost of training from a uniform distribution from CHF 840 to CHF 7000, cost of quitting workforce from a
uniform distribution from CHF 50,000 to CHF 120,000, and the probability of regret from a triangular distribution from probability of regret divided by 2 to probability of regret times 3, with the likeliest value being probability of regret in this model.

**Results**

The no training strategy was strongly dominated since costs were estimated at CHF 11,106.9 for the training strategy (effectiveness of 0.797), while the no training strategy had costs estimated at CHF 14,912.2 (effectiveness: 0.775).

In a one-way sensitivity analysis, varying the cost of training showed that it could increase up to CHF 4600 and the training strategy would still remain dominant. However, even a small increase over that threshold led to very large cost-effectiveness ratio, rapidly rising over the willingness to pay threshold.

Probabilistic sensitivity analysis (100 outer loops, 10000 cases) showed that the dominance of the training strategy was robust to changes in probability of experiencing a regret, cost of training and cost of quitting the workforce (Figure 5).

Figure 5: Incremental cost (CHF) of training strategy versus no training strategy as a function of incremental effectiveness (Personal contribution)
Based on these unanimous results, the value of perfect information is not really useful as the decision is already evident. However, a larger probabilistic sensitivity analysis is necessary to determine the limit of the cost of training in conjunction with other costs and probability of regret.

**Discussion**

This study evaluated the cost-effectiveness of a short training program to enhance regret coping. The results showed that providing training to everyone was a dominant strategy as long as the cost of the training program was less than CHF 4500. However, once the cost of the training exceeds this threshold, willingness to pay is not really relevant because the cost-effectiveness ratio increases very quickly. This rapid increase in cost-effectiveness ratio is due to the fact that the training strategy mostly impacts the cost, and not the effectiveness (incremental effectiveness = 0.02). Probabilistic sensitivity analyses showed that the dominance of the training strategy was robust to changes in cost of training, cost of quitting the workforce and probability of experiencing a regret.

The microsimulation results as well as the sensitivity analyses are promising and support the idea that a training could be cost-effective.

There are several important limitations to this study. First and most importantly, several parameters were uncertain and based on guesses. Since there is no training on regret coping for physicians, estimates of the effect of this training are currently impossible to obtain. Thus, the next step is to acquire very good estimates of all other parameters and focus the sensitivity analyses on the effect of training. In other words, the final question before investing the time and money to create the training is: how effective does the training have to be in order to be worthwhile in terms of cost-effectiveness? The cohort study described previously should help obtain precise estimates of the causal impact of regret on sleep problems, sickness leave and turnover, allowing a better evaluation of how much a training program could cost (in terms of time and money) while still being cost-effective to reduce sickness leave and turnover.

A second limitation concern the Markov model itself. In the model presented in this study, regret had an impact only on sick leave, quitting the workforce, anxiety and sleep. But regret may have many more impacts. In particular, it may be associated...
with patient outcome in two ways: 1) physicians may learn from their regret to improve their practices, and 2) regret may lead to sleep and concentration problems, attention deficits (through lack of sleep) and finally to more medical errors.

A third limitation concerns the temporal unfolding of the events. The probabilities were generally considered independent of time in this study. In particular, for the probability of being sick, this assumption is unreasonable even for a single year since people take more sick leave during the winter. But more generally, regret may have less impact over time as physicians become more experienced at dealing with, and sometimes avoiding, regret-inducing events. A longitudinal study of physicians examining regret, regret coping strategies, and variables potentially influenced by regret will need to collect data every week to determine the variability of the impact of regret and the potential diminution of this impact over time. In order for this study to be not too costly, a burst measurement study (e.g., several iterations of 10-week trains of weekly measures separated by 6-month measurement interruptions) should be launched.

A fourth limitation concerns the generalizability of this study to other population. In particular, US physicians may have a much lower probability of quitting their job since they often have loan to reimburse and may thus have extra incentives to remain healthcare providers.

In conclusion, physicians should profit from a training on regret coping strategies, provided this training costs less than approximately CHF 4,500.

**Impact of a training to improve regret coping: a randomized controlled trial**

Developing a training to help improve regret coping is very relevant in the current situation of increased healthcare cost, and shortage of healthcare personnel. Furthermore, many hospitals, including the University Hospitals of Geneva, now try to focus more on the well being of their collaborators. The cohort study will provide rich
data to develop a training program tailored to help healthcare professionals to cope with their regretted healthcare situations. This training could help reduce sickness leave due to sleep problems or burnout, and could also potentially lower turnover. This is especially important since the cost of training new healthcare professionals is important.

Regrets associated with providing healthcare cover a variety of feeling like culpability and shame, which can be extremely psychologically destructive for healthcare professionals (loss of self-confidence, exhaustion, etc.). However, good healthcare need to be provided by healthcare professionals in good health and, specifically, in good mental health conditions. This premise is becoming one of the founding pillars of the quality and safety of care. In Switzerland, such an issue has been addressed by the Swiss Patient Safety Foundation, which offers, since 2011, continuing trainings to health professionals having committed an error (who are the “second victims”), to give them resources on how to cope constructively with errors.

The occurrence of regrets depends essentially on external factors that can hardly be controlled by individuals nor influenced by an intervention. In contrast, regret regulation strategies are open to modification. Healthcare professionals too often use ineffective strategies, such as self-attacking. Furthermore, the strategies used do not seem to improve with experience. Over the course of the cohort study, we will start developing a training program to protect against the negative effects of regret. This program will draw on tools, techniques and strategies that have been successfully employed in cognitive-behavioral therapy for anxiety and stress. The goal is to give the training, in a pilot study, to small mixed-profession groups of healthcare professionals. On the theoretical level, it will, for example, provide information on regret occurrence, regret prevalence and on available support groups in the institution; discuss regret coping strategies in order to enlarge healthcare professionals’ set of regret-coping skills; and teach which strategies are more efficient in different situations. On the practical level, it will, for example, offer hands-on sessions to facilitate seeking social support early, decentration, and mindfulness exercises.

Study design

Eligible participants will be all new nurses and physicians starting their residency. To detect a mean difference of 1 point between training groups and sleep problems
with an alpha of 0.05, power of 0.80, and assuming a standard deviation of sleep of 2.5, a sample size of 100 participants is necessary. Since the effect of the training may differ between professions, we will recruit 100 nurses and 100 physicians. Recruitment will be done in 2 different hospitals and could be done over two years if the human resources department offers their support. Note that the human resources director of the HUG knows about the project and is theoretically interested, provided we had the necessary personnel to provide the training without additional costs to the institution.

The training cannot be done for everyone simultaneously. Thus, a delay between trainings is inevitable. This necessary waiting list for the training is an opportunity for a designed delay study. The designed delay allows randomizing participants without forcing any person to forego the training. Participants will be randomized in two groups, those who receive the training during the first month of working at the hospital, and those who receive the treatment 6 months later. In order to have an active comparator, all nurses and physicians eligible for the study will receive a letter presenting the difficulties of providing healthcare, and the potential consequences of the ensuing regrets, and available support.

Variables similar to the ones described in the cohort study will be measured every week for 1 year through an Internet survey. For the immediate training group, there will be a single pre-training measure (since care-related regret cannot be measured before start of work) and a one-year follow-up and the delayed training group, there will be 6 months pre- and 6 months post-training.

**Intervention:** The regret regulation training will be given to small groups of 10 people, mixing nurses and physicians. It will be based on cognitive-behavioral theory, and focus on three facets.

1. Increasing knowledge of what healthcare professionals will face, using discussion with experienced professionals, role-playing games, and presenting research on medical errors. This will also show novice healthcare professionals that difficult situations and regrets are a normal part of their chosen profession.

2. Presenting all regret regulation strategies and emphasizing that no strategy is the best. Similarly to a diversified diet in nutrition, a diverse set of strategies is
better for health. To help healthcare professionals determine which strategies they are using, they will fill a diary, noting their emotions, their cognitions, and their physical symptoms (e.g., a knot in my stomach). The presentation of the regret regulations will include practical exercises, for instance power naps, yoga, mindfulness meditation.

3. Giving novice healthcare professionals information about support groups (e.g., BALINT), and other available supports.

This study would have several strengths. First, the designed delay method would allow offering the training program to everyone, which is ethically more acceptable, and at the same time provides a randomized experiment facilitating a causal interpretation. Second, the rich data over 1 year would give a detailed image of the development of critical coping skills necessary to provide healthcare while remaining in good health. Third, the causal impact of the training and the duration of the impact would be assessed because of the relatively long follow-up period. Finally, this study may provide the first data to estimate the costs associated with not providing sufficient support to healthcare professionals in terms of sleep problems, sick leave, and turnover.

This study may also have some limitations. First, there could be some differential loss to follow-up, which would mitigate the benefit of the randomized experiment. Second, time varying confounding may also occur after randomization, and careful modeling will be necessary to check this possibility. Third, there could be some spill over between training groups so that the delayed training groups may learn some techniques from the immediate training group. However, this spill over would bias the results towards the null and thus if our results show a significant effect of training, the spill over effect will not be the cause of this finding. Fourth, recall bias and reappraisal of events are always potential problems with self-report measures. However, the one-week interval between measures should limit this problem. Finally, this study cannot determine if the training program has the same effect if given immediately or 6 months later.
References


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Regrets Associated with Providing Healthcare: Qualitative Study of Experiences of Hospital-Based Physicians and Nurses

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Abstract

Background: Regret is an unavoidable corollary of clinical practice. Physicians and nurses perform countless clinical decisions and actions, in a context characterised by time pressure, information overload, complexity and uncertainty.

Objective: To explore feelings associated with regretted clinical decisions or interventions of hospital-based physicians and nurses and to examine how these regrets are coped with.

Method: Qualitative study of a volunteer sample of 12 physicians and 13 nurses from Swiss University Hospitals using semi-structured interviews and thematic analysis

Results: All interviewees reported at least one intense regret, which sometimes led to sleep problems, or taking sickness leave. Respondents also reported an accumulation effect of small and large regrets, which sometimes led to quitting one’s unit or choosing another specialty. Respondents used diverse ways of coping with regrets, including changing their practices and seeking support from peers and family but also suppression of thoughts related to the situation and ruminations on the situation. Another coping strategy was acceptance of one’s limits and of medicine’s limits. Physicians reported that they avoided sharing with close colleagues because they felt they could lose their credibility.

Conclusions: Since regret seems related to both positive and negative consequences, it is important to learn more about regret coping among healthcare providers and to determine whether training in coping strategies could help reduce negative consequences such as sleep problems, absenteeism, or turnover.

Introduction

Regret is an unavoidable corollary of clinical practice. Physicians and nurses perform countless clinical decisions and actions during their workday, in a context characterised by time pressure, information overload, complexity and uncertainty [1]. Inevitably, some of these decisions and actions will be suboptimal or wrong, or appear such to their authors in retrospect. Indeed, a worsening of patients’ condition may follow even the best decisions or wrong, or appear such to their authors in retrospect. Regret is an emotion experienced when one believes that the current situation would be better if one had behaved differently [2]. Given that 98% of interns have admitted to committing medical errors [3], regret is presumably frequent among healthcare professionals. Little is known about the experience of regret in physicians and nurses.

Furthermore, those who experience regret usually rely on coping strategies. One classification of these strategies proposes three categories: cognitive, action-oriented, and social [2]. Cognitive strategies include suppression of regret-related thoughts. Action-oriented strategies aim at preventing similar situations in the future. Social strategies consist in seeking either an attentive ear or concrete support from others. How these strategies are used depends on the context of the decision, the decision maker finds acceptable upon making a wrong decision, and the level of acceptable regret (i.e., regret of inaction [11]). The level of acceptable regret (i.e., regret of inaction [11]). The level of acceptable regret (i.e., regret of inaction [11]).
decision) influence the decision to order a test [12]. Second, regret also influences physical and mental health. The intensity of regret is associated with feelings of loss [13] and with a wide range of physical and psychological symptoms [14]. Regret may also disturb sleep [15]. Given that sleep loss may lead to attention deficits [16] and thus to an increased risk of errors, a vicious circle between errors, regrets, and insomnia could thus emerge [17]. Finally, intense regrets may decrease job satisfaction and may eventually lead to the decision to change jobs.

The aim of this study is to explore feelings of regret associated with clinical decisions or actions of hospital-based physicians and nurses, and to investigate how healthcare professionals cope with these feelings. As healthcare professionals have to make many decisions and act during their workday, an additional aim of this study is to examine whether the theoretical framework used to describe coping strategies is consistent with physicians’ and nurses’ feelings of regret and coping strategies.

Methods

The study was approved by the Research Ethics Committee of the University Hospitals of Geneva. In this qualitative study, as accepted by the Research Ethics Committee, verbal informed consent was obtained from participants at the beginning of the tape-recorded interview. The names of the interviewees were not evoked during the tape-recorded interview and thus the names did not appear in the transcripts. Thus, only the interviewer (SC) knew the identity of the participants.

Participants and setting

Over five months, 25 participants were recruited by posting information about the study on the intranet news page of the University Hospitals of Geneva and on the website of the clinical epidemiology division, as well as by presenting the study during division seminars. We sought to include similar numbers of physicians and nurses, representing all types of clinical practice. Twelve participants were physicians (4 female; 5 senior physicians) and 13 were nurses (11 female; 5 senior nurses). Participants came from departments of anaesthesiology (N = 6), internal medicine (N = 4), visceral surgery (N = 3), obstetrics (N = 2), infectious diseases (N = 2), pediatrics (N = 1), emergency psychiatry (N = 1), intensive care (N = 1), haematology-oncology (N = 1), nursing management (N = 1), international and humanitarian medicine (N = 1), and palliative care (N = 1). Mean age was 40 years (range 27–64).

Interviews

Face-to-face semi-structured interviews were conducted between April 2009 and September 2009 (questions: Box S1). At the beginning of the interview, regret was defined by the interviewer and clearly differentiated from medical error (i.e., medical error could elicit regret but regret could stem from situations that did not involve a medical error). Interviewees were then asked to describe at least two patient-care situations in which they experienced regret, one in which they felt they made a mistake and one in which they did not. Specific questions concerned the situation eliciting regret, the emotions, thoughts and physical sensations occurring during the situation, the consequences for the healthcare professional’s life, and the coping strategies used by the healthcare professional (Box S1). The interview included two closed-format items: respondents rated the intensity of their regrets on a visual analogue scale from 0 (no regret) to 10 (very high), at the time of occurrence of the event, and at the time of the interview. Interviews lasted on average 52 minutes (range 31–88). All interviews were tape-recorded and fully transcribed.

Analysis

Analysis focused on identifying thoughts and other emotions experienced in relation to situations in which respondents experienced regret, and on identifying coping strategies used by respondents in these situations. SC and DC read the first 10 interviews independently, noting significant emergent themes (e.g., use of acceptance of one’s limits to cope with regret) and passages. Interviews were also examined for instances of pre-defined, literature-based codes related to coping strategies (e.g., use of suppression coping strategy) and for a documented consequence of regret: sleep difficulties. After comparing their results and resolving any discrepancies, a definitive list of codes and a set of coding rules were developed. SC then coded all interviews, which were reviewed by DC. Transcripts were also reviewed by physicians to provide an accurate interpretation of the clinical situations. Coding was performed using Nvivo 8 software (QSR International Pty Ltd; Doncaster, Victoria, Australia). Approximately 75% of the theory-driven coding categories were very rarely used and therefore discarded. In the end, half the categories used were predetermined and half were emergent.

Results

The 25 participants reported 61 situations in which they experienced regrets. Three situations were excluded because they did not concern patient care but relationships with colleagues, and another was excluded because the respondent was not able to describe a specific situation. Finally, 57 regretted situations were included in the analysis. On average, the respondents reported two personally significant regrets (range 1 to 5).

Respondents were often very emotional during the interviews and seven out of 25 cried or were on the verge of tears. Furthermore, several respondents were very interested in any help we could provide in dealing with regrets.

Regret-inducing situations

Regret was experienced in a wide range of situations including diagnosis, administration of a treatment and its outcomes, patient healthcare management and inter-personal relations between the patient (or his family) and the healthcare provider. Additionally, several nurses reported situations in which the points of view of the patient and of the physician differed; these situations related either to different conceptions about end-of-life care (palliative care vs. pursuing curative interventions), or physicians’ respect of the patient’s intimacy.

“I am cleaning a patient, the drapes are closed, the physician arrives, I hear noises, he enters without asking and voluntarily, I say: ‘Careful, we're doing intimate cleaning’ [...]. I shock on purpose, some are embarrassed, and others don’t even hear me.’’ (nurse)

Most situations took place in the hospital, but some respondents depicted other settings such as homecare or occupational health. Only half of the respondents reported a situation in which the regret was linked to a mistake or error (examples: Box S2). Respondents also regretted situations in which no obvious mistakes were committed (examples: Box S3). Indeed, three fourth of the reported situations were not related to a mistake. Each citation will be preceded by a number in bracket indicating which situation the citation refers to or by an X if the citation is a generality.

Many respondents described intense experiences that dated back to their first years of clinical practice. Strong regrets typically entailed a great shock to professional identity, for both physicians and nurses.
Additionally, more than half of the respondents reported that they regularly experienced regrets for “small things” that did not have major consequences.

Regret intensity. On the visual analogue scale from 0 (no regret) to 10 (very high), mean intensity at the time of the event was 7 [range 1.5 to 10; N = 52] and 3 at the time of the interview [range 0 to 10; N = 25]. Intensity was equivalent for regrets that were related to a mistake and for regrets that weren’t.

Emotions. Generally, respondents expressed more than one other emotion felt during the regretted situations. In decreasing frequency, these emotions were guilt, anger, sadness, shame, helplessness, and a feeling of unfairness/injustice. Anger was either self-oriented or oriented against a target (e.g., the patient, the institution, the situation, colleagues).

"A very strong feeling of shame. Shame, yes, very strong. And then, in a way, of anger [...] towards myself, and towards the institution too.” (physician).

"I find it a pity, as a human being, that he left (died) like that. Especially the discomfort also, not knowing how he left. We found him with the mask between his legs… Did he struggle, did he… It’s sadness yes… (long pause).” (nurse)

Thoughts
The majority of regrets were related to an action, the remainder were regrets of inaction. During the situation, respondents either thought about the consequences of their action or about what else they could have done:

"With the fear, where I tell myself ‘if I make a mistake, if anything happens...’” (physician).

Physical manifestations. During the regretted situation, more than half of the respondents also experienced physical symptoms, such as, in decreasing frequency, stomach ache, throat/chest oppression, headache, hot flushes, trembling, palpitations.

"And there, I thought I was going to faint, I felt so bad (laughs) [...] My heart was beating at 200. [...] heart burn, feelings of squeezing, of tingling [...] And then every time we talked about it, there was a lump [in my throat].” (nurse)

"It’s more the heart that goes too fast, the impression that the floor vanishes under my legs [...] and hot flushes, maybe even feeling dizzy.” (nurse)

Regret regulation strategies
When asked how they coped with their regrets, both physicians and nurses reported using several strategies, which were grouped under three headings: cognitive, action-oriented and/or social strategies.

Cognitive strategies. Respondents described four main cognitive strategies. The most frequent strategies were rumination (i.e., recurrent thoughts about the situation) and suppression (i.e., trying to not think about what happened). Sometimes, suppression was considered as a transitory measure, a voluntary way to block overwhelming emotions.

"I'd say one event erases another. When I had other worries afterwards, we can't deal with everything at the same time [...] We have other reasons to have regrets and then the first regrets lose their intensity (laughs).” (physician)

"Finally, I feel that we could almost have regrets every day, be they small or large.” (nurse)

Usually these daily minor regrets were quickly forgotten, but there was an accumulation effect.

"It’s true that we have regrets everyday in a way, not vital stuff but for example, we make a great deal of effort to take care of the patients and then we don't have time to see them again [...]. We have kind of small regrets every day that finally lead to small frustrations about our work.” (physician)

"It helps also to tell yourself that you did what you could, we’re just human after all, there is a moment when it’s not possible [to keep going] anymore, it’s not possible whatever happens.” (nurse)

"And everybody knows that we make mistakes in our lives and maybe once it cost the life of a patient.” (physician)

The third most frequent strategy was acceptance of both one's own mistakes and the consequences of those mistakes.

"In this type of situation, we redo the scenario 50 times in our head, again and again, we think, ‘I should have done this differently.’” (physician)

"Even at night, well, you don’t sleep, you take a sleeping pill because at 1 am, 2 am, well […] it doesn’t stop when you leave the hospital, no it’s quite hard, quite difficult.” (nurse)

The majority of regrets were related to an action, the remainder were regrets of inaction. During the situation, respondents either thought about the consequences of their action or about what else they could have done:

"Why didn’t I go explain myself to the patient, why didn’t I apologize?” (nurse)

"It didn’t have enough distance towards nature and towards the acceptance that death happens even for a young (adult) if he has a severe accident.” (physician)

Finally, regret sometimes led to self-attacking (i.e., criticise one's whole self and not only one's action).
Regrets Associated with Providing Healthcare

Action-oriented strategies. Healthcare professionals who implemented action-oriented strategies mostly did so after intense regrets. Three main action-oriented strategies were reported. First, respondents often tried to take responsibility for the event (e.g., a nurse bathed the dead patient that she felt she had not supported as much as she should have, physicians went to talk to the patient to give explanations or present excuses). Second, some healthcare professionals reported that they became more vigilant about this type of event and tended to repeat check-up procedures more often.

Finally, guidelines were sometimes created to avoid similar incidents in the future.

Social strategies. Social strategies were regularly adopted by nearly all interviewees. Social support was most often sought among peers (i.e., colleagues of the same profession), but sometimes also by talking to one’s relatives (e.g., spouse).

While respondents often reported that they used social support to reduce negative outcomes such as rumination (2.7) and urge to quit (2.5), they also underlined the limits of this strategy (3.13).

Consequences

Almost all respondents indicated that the regrets they described influenced their private or professional life. The most frequent consequence was sleep difficulties (for about half). Respondents reported either thinking too much about the situation before sleeping, bad quality of sleep, and/or nightmares.

For some respondents, the regret-eliciting episodes set the course for their careers. Indeed, four participants (two nurses and two physicians) reported that the regret-inducing episode had led them to quit a service and/or to opt for another specialty.

Discussion

All interviewees reported at least one intense regret, which often stemmed from situations that occurred during the first years of clinical practice. Even though half the respondents reported one error-related situation, most situations described were not related to errors. As expected from general population findings, both suppression and rumination of thoughts related to the regret-inducing situation were frequent [18]. This is consistent with the respondents’ reports of sleep troubles as suppression is a known cause of such problems [18]. Furthermore, both physicians and nurses often sought social support, mainly from colleagues. Some examined the event inducing the regret and made changes in their practice, as advised by literature on coping with mistakes [19].

This study uncovered some new results that may have important consequences at several levels. For healthcare professionals, regret often led to loss of confidence and self-esteem. This
may have a negative impact on the performance of clinical tasks. Furthermore, interviewees reported a cumulative effect of small regrets, that, separately, were soon forgotten, but, taken together, amounted to an important burden. This accumulation could be related to emotional exhaustion, one of the components of burnout [20], which in turn could lead to increased turnover [21,22]. It could also be related to depression, which may result in higher rates of medications errors [23].

At the level of patient care, regret may reduce the risk of errors, if it motivated learning from one’s mistakes [24] and the implementation of preventive measures. Conversely, regret could also increase errors due to concentration problems of the healthcare providers, but also because of a widespread use of a strategy of acceptance of medical errors [19,25]. This strategy of acceptance, which is rarely used in the general population [26], could be dangerous for patient safety if it led to greater acceptance of preventable mistakes.

At the institutional level, regret could be one of the causes of absenteeism and turnover rate among nurses [27] since it sometimes led to sleep problems, taking sickness leave days or to definitive change in professional trajectories. Indeed, our sample of working healthcare providers by definition excluded all caregivers who quit their job and thus reported comments about turnover were probably partial and underrepresented.

Finally, one finding may impact on all three levels. While nurses talked more to colleagues of the same unit, physicians, on the contrary, avoided close colleagues. Indeed, physicians reported feeling that it was risky to talk to close colleagues because they could lose their credibility [28]. At the individual level, this barrier to physician peer support may block an effective coping strategy. At the patient care level, it could lead to fewer requests for clinical support [29] and thus suboptimal decisions and actions [30]. At the hospital level, it may lead to fewer incident reports [31].

Strengths and limitations

This study used rich data provided by a diverse sample of informants on an important but underinvestigated topic. To minimize the risk of taking some observations for granted, the interviews were conducted by a non healthcare provider (i.e., a sociologist). However, to minimize the risk of missing important contextual information in the interviews, transcripts were reviewed by physicians, who also provided an accurate interpretation of the clinical situations.

As in all qualitative studies, our study sample was small and the generalizability of findings may be limited to people and settings with characteristics similar to those studied here. Furthermore, our sample was composed of volunteers, who may have experienced more regret or regret of stronger intensity than the general healthcare providers. This study examined regret and related coping strategies retrospectively. Thus, respondents’ reports may be limited by recall bias. In addition, recent regrets often concern actions whereas older regrets are mostly regrets of inaction [32]. Since respondents mostly reported situations that occurred during their first years of clinical practice, the occurrence of regrets of inaction may be overestimated in this study. Moreover, some cognitive strategies such as reappraisal (analyses of what happened, and what went wrong) may have transformed the recall of the situation so that they no longer appear regret-inducing. These strategies would then not be reported.

Conclusion

Since regret seems to be related to negative consequences such as sleep problems and turnover but also to positive consequences such as changes in practice to avoid further regret-inducing situation, it is important to learn more about regret regulation among healthcare providers. Further research is needed to explore regret prospectively and to determine whether training in regulation strategies could reduce negative consequences such as sleep problems, absenteeism, or turnover.

Supporting Information

Box S1 Interview Guide. (DOCX)

Box S2 Examples of regretted situations involving mistakes. (DOCX)

Box S3 Examples of regretted situations not involving mistakes. (DOCX)

Acknowledgments

The authors thank the physicians and nurses who participated in the study and also Anne-Marie Stragiotto and Sandrine Rudaz for transcribing the interviews. They also thank Patricia Hudelson for her useful suggestions.

Author Contributions

Conceived and designed the experiments: DSC TA TVP RES SC. Performed the experiments: SC. Analyzed the data: SC DSC TA. Wrote the paper: DSC TA TVP RES SC.
Clinical decisions or actions may not always yield the best results. Indeed, patients’ conditions may even worsen whether or not the decision or action was the best possible choice. We would like you to talk about two situations that led to a regret, one in which you feel you may have made a mistake and one in which you did not. In both cases, you should report your most significant regret. For each regret:

**Eliciting event**
What was your most significant regret following a clinical decision or intervention? Were any of your colleagues aware of the event?

**Associated emotions and consequences**
What emotions did you feel at the moment of the event?
What did you think at the moment of the event?
Some people feel regrets physically in their bodies, whereas others do not. How about you, what did it feel like?
On a scale ranging from 0 to 10 (0 being equal to no regret and 10 to very strong regret), what value would you ascribe to the intensity of this regret at the time of its first occurrence?
If this regret is still active and present, what is its intensity today?
Have thoughts in connection with this event kept you awake at night?
To what extent did this regret intrude in (e.g., prevented you from concentrating on) your private life? And in your professional life?

**Regret coping strategies**
How did you cope with this regret?
Have you changed your clinical practice in the wake of this event? If yes, how?
To what extent have you talked about it with colleague(s)? With your superiors? With your friends and family?
Physicians
1. A house officer treating a patient with a metatarsal fracture gave non-steroidal anti-inflammatory drug to avoid deep venous thrombosis. Ten days later, the patient was readmitted for a massive pulmonary embolism. The patient responded well to treatment. The house officer later learned that he should have given anti-coagulants instead.

2. An obstetrician, thinking out loud, inadvertently informed the parents about the sex of their expected twins. Parents were shocked and told her that they did not want to know.

3. During a night shift, a young house officer in paediatrics admitted a child with a recent renal graft. The patient had a respiratory arrest related to a pulmonary oedema that the house officer had not detected. The patient was intubated and transferred to the ICU. No information on follow-up.

4. An anaesthetist in charge of the recovery room broke bad news to the spouse of a patient. While speaking, he realised that he was talking about the wrong patient. He apologised to the spouse and told her that her husband was doing well.

5. A physician provided anaesthesia to an 85-year-old woman with several co-morbidities using a regimen appropriate for a healthy 20-year-old patient. The patient had a cardiac arrest, and was reanimated successfully without further consequences.

Nurses
6. A nurse started the infusion of chemotherapy on a patient without having received the results of the last blood tests and the physician's authorisation. Blood tests later confirmed that the patient had no contraindication for this chemotherapy.

7. A nurse put the vaginal probe used to examine an HIV+ patient in a common cleaning tub for all probes. She immediately discarded all probes and phoned a colleague working with HIV patients. Her colleague told her that there was no significant risk of infection.

8. A nurse entered a room to administer insulin to a patient and called her name. One of the two patients present said yes and the other did not react, so the nurse gave the insulin dose to the first patient. Thirty minutes later, the nurse realised that she gave the insulin to the wrong patient. There were no consequences.

9. A nurse injected 10 times the dose of an analgesic drug to a newborn in an ambulatory setting. The baby had to stay under observation for a night; there were no consequences for his health.

10. A nurse student was supposed to give an aerosol to a patient under continuous oxygen therapy. The aerosol had to be connected to the mask. She asked the patient, who seemed cognitively sound and had already done the operation under supervision, to do it herself, and then left the room. Twenty minutes later, she found the patient unconscious without her mask. The patient was sent to the ICU and died shortly thereafter.
11. A nurse in a psychiatric emergency ward was asked by a recently admitted well-known patient to look into her cell phone, get the number of her new companion and call him. The nurse did not do so, but nevertheless told the patient that she tried and did not manage to reach him.
Physicians
1. A house officer looked at a follow-up x-ray of a patient who had been hospitalised for pneumonia. He told his chief that he thought the pneumonia might have recurred. His chief told him to wait. At the visit the next day, the patient was much worse. Later that day, the patient went into septic shock, was transferred to the ICU, and died.

2. A drug user patient was treated for pneumonia without significant improvement. The house officer in charge wanted to perform additional tests but her chief disagreed. She regretted not standing up to her chief and wondered if the patient had side-effects due to delaying the more appropriate treatment.

3. A patient with a chronic disease did not take his treatment regularly, thus considerably reducing its effectiveness and potentially inducing resistance. Hoping to change his behaviour, a physician talked harshly to him. The patient broke contact.

4. A patient was admitted with a dissecting thoracic aorta aneurism and had to undergo urgent surgery. A senior house officer, who had not slept all night for personal reasons, did not report his tiredness and performed the surgery nevertheless. The surgery went well and the patient survived.

5. At the end of a long operation that went well, a patient was extubated and showed respiratory distress. The reintubation was difficult and the physician tried to perform a tracheotomy. He failed, which caused massive subcutaneous emphysema. The patient died.

6. An anaesthetist told a patient that she would perform the anaesthesia on her but finally was not able to do it herself. In the recovery room, the patient reproached her for not doing it.

7. A physician was sent by helicopter to rescue a patient in a mountain accident. Despite the physician’s efforts, the patient died.

8. A cardiac catheterization was performed on a patient with a massive pulmonary embolism. The patient could not be sedated during the procedure for medical reasons, and thus remained awake and in pain. The patient had a complication and died during the procedure.

Nurses
9. A nurse who was alone at night had to face several difficult situations at the same time: supporting a family after an expected death, attending to a patient in agranulocytosis who fell and broke her nose, a patient with ileus and acute chest pain, and a COPD patient in respiratory distress. She regretted not being able to deal to her satisfaction with all these situations because she was too stressed.

10. A patient with respiratory distress was transferred from the emergency room to a medical ward for palliative care. The patient died less than two hours later and was found by his brother with his mask between his legs. The nurse regretted that she did not provide comfort care immediately and that the patient was found by a family member.
11. A patient in a medical ward, who was supposed to receive only palliative care, was still examined regularly. The nurse had to take blood samples every two hours and temperature every 30 minutes. The patient died one hour after the last blood tests.

12. A patient was supposed to receive a permanent catheter. The nurse received information that his platelet count was too low but did not reprogram the procedure. The patient had to come back at a later date, and the nurse unknowingly transfused him with non-conform platelets that caused a massive shock. The patient survived. The nurse regretted not seeing that his platelets count was too low before his visit because he would then have been transfused with another batch of platelets.

13. A patient who had been hospitalized for three weeks finally died in acute respiratory distress. Thinking the patient would survive, the nurse did not call the family, even though she knew that the family wanted to be present at the end.

14. A nurse was attending to a 40-year-old patient with terminal cancer in much pain. The nurse thought that she would probably die during the night, but felt incapable of seeing her because it was “emotionally unbearable”. She asked a colleague to go and see her in her place, but her colleague answered that she was too busy. The patient died alone during the night.
Validation of a 10-item Care-related Regret Intensity Scale (RIS-10) for Health Care Professionals

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Ralph E. Schmidt, PhD, || Guy Haller, MD, PhD, † ‡ Thomas Agoritsas, MD, † ‡
and Thomas V. Perneger, MD, PhD †

Background: Regret after one of the many decisions and interventions that health care professionals make every day can have an impact on their own health and quality of life, and on their patient care practices.

Objectives: To validate a new care-related regret intensity scale (RIS) for health care professionals.

Research Design: Retrospective cross-sectional cohort study with a 1-month follow-up (test-retest) in a French-speaking University Hospital.

Sample: A total of 469 nurses and physicians responded to the survey, and 175 answered the retest.

Measures: RIS, self-report questions on the regret-inducing event, its consequences for the patient, involvement of the health care professionals, and changes in patient care practices after the event. We measured the impact of regret intensity on health care professionals' own satisfaction with life scale, the SF-36 first question (self-reported health), and a question on self-esteem.

Results: On the basis of factor analysis and item response analysis, the initial 19-item scale was shortened to 10 items. The resulting scale (RIS-10) was unidimensional and had high internal consistency (α = 0.87) and acceptable test-retest reliability (0.70). Higher regret intensity was associated with (a) more consequences for the patient; (b) lower life satisfaction and poorer self-reported health in health care professionals; and (c) changes in patient care practices. Nurses reported analyzing the event and apologizing, whereas physicians reported talking preferentially to colleagues, rather than to their supervisor, about changing practices.

Conclusions: The RIS is a valid and reliable measure of care-related regret intensity for hospital-based physicians and nurses.

Key Words: regret, validation, psychometric, scale, quality of life, healthcare professionals

Regret plays a key role in various types of decisions and particularly in clinical decision making. Physicians and nurses perform countless clinical decisions and actions during their workday, in a context characterized by time pressure, information overload, complexity, and uncertainty. Inevitably, some of these decisions and actions will be suboptimal or inappropriate, or appear such to their authors in retrospect, thus resulting in the experience of regret. More formally, regret is defined as the emotion after an experience in which one feels responsible for negative outcomes. Among health care professionals, regret can occur in various clinical situations, for example when caregivers feel a lack of control in patient care (loss of therapeutic adherence or patient's condition worsening unexpectedly), when they commit errors, or when they feel patient's dignity is not respected. Regret may lead to 2 types of consequences: changes in clinical practices and negative impact on health care professionals’ own health and quality of life.

CLINICAL PRACTICES

Although the influence of cognitive processes on medical decisions has been extensively studied, the impact of affective processes has as yet received little attention. Regret may be anticipated, and health care professionals may make decisions to avoid potential regrets. For instance, the level of acceptable regret—that is regret that a decision maker finds acceptable upon making a wrong decision—influences the decision to order a test. Before medical decisions, physicians’ intentions to vaccinate adolescent girls against human papillomavirus are correlated with anticipated regret of inaction. In addition, regret may also lead to a suboptimal physician-patient relationship. Yet the wider impact of regret on clinical decisions, or patient outcomes, remains poorly understood.

HEALTH CARE PROFESSIONALS’ HEALTH AND QUALITY OF LIFE

Another key reason to explore regret in health care concerns its influence on the physical and mental health of care providers, with a potential impact on patient
outcomes. Previous work has suggested that regret is associated with sleep disorders, and attention deficits, thereby potentially increasing the risk of errors.

Despite its importance, the exploration of the impact of regret in health care is currently limited by the lack of an available instrument to measure regret intensity. The development of a short and easy-to-use scale of regret intensity associated with providing health care for both nurses and physicians is needed. The aim of this article is to report on the development and validation of such a scale.

METHODS

Study Design

The study was conducted at the University Hospitals of Geneva, a Swiss public teaching hospital network including acute and primary care, psychiatric and geriatric facilities, and totaling about 2000 beds. Questionnaires were sent to health care providers by mail in 2011 with up to 3 reminders. According to recommendations, and assuming a 20-item scale, a study sample of 200 nurses and 200 physicians was required. Questionnaires were sent in 2011 to 825 nurses and 825 physicians. Of these 1650 questionnaires, 1100 could be identified by a subject-specific number and 550 were completely anonymous, with no identification allowing a retest. Comparison of the 2 questionnaires showed no differences in response rate, and further results in this study are obtained on the anonymous, with no identification allowing a retest. Comparison of the 2 questionnaires showed no differences in answers, and further results in this study are obtained on the pooled survey (data not shown). Exclusion criteria were (a) not working with patients for the last 5 years or (b) recent retirement. In addition, respondents were asked if they would be willing to complete the questionnaire again 1 month later, to assess test-retest reliability; the retest survey was sent to volunteers only. The study was approved by the Research Ethics Committee of the University Hospitals of Geneva.

Scale Development

In a first qualitative study, we explored the main components of the emotion of regret, that is the feelings, physical manifestations, and cognitive processes associated with regretted clinical decisions or interventions of hospital-based physicians and nurses. This qualitative study used semistructured interviews to ask respondents to describe 2 regret-eliciting events—1 related and 1 unrelated to an error—as well as how they reacted to this event and coped with their regret. Although the interview guide and the analysis were partly based on theory, approximately half of the main themes emerged from the interviews. Respondents expressed >1 other emotion felt during the regretted situations, including guilt, anger, sadness, shame, or helplessness. More than half of the respondents also experienced physical symptoms, such as stomachache or throat/chest oppression. Furthermore, many reported recurring thoughts, often related to sleep disturbance or concentration difficulties associated with regret.

On the basis of this qualitative exploration, we generated 30 items to measure the affective, physical, and cognitive intensity of regret among health care professionals. These items were examined by a panel of 6 experts, including 2 psychologists, 3 physicians, and a sociologist. The scale was pretested among 14 nurses and 5 physicians working at the University Hospitals of Geneva. We dropped 11 items, because they were poorly understood, or because testers all answered these questions similarly, which yielded a 19-item scale. To recall a regret-inducing event, they were asked to think back to the event occurring with a patient, within the last 5 years, that they regretted the most today. Then, for each item, participants were asked to rate their agreement on “how they feel now” from 1 (strongly disagree) to 5 (strongly agree).

Questionnaire and Variables for Construct Validation

In addition to the 19-item regret intensity scale (RIS), 2 questions probed the self-perceived involvement of the health care professionals in the regret-inducing event, assessing responsibility (“With respect to your responsibility in the event provoking your regret, would you say you have answered from 0 (no responsibility) to 10 (very high responsibility), as well as whether the event was related to an error (“According to you, did this event imply an error on your part” answered yes or no). Additional questions concerned the consequences of this event for the patient [eg, discomfort, transfer to intensive care unit (ICU), death]. These questions could be answered by “I don’t know,” in which case the answers were then recoded as missing. Finally, several questions assessed the change in patient care practices usually made by the health care professionals following regret-inducing events (eg, “I expose the situation to colleagues to improve our practices”). Answers ranged from 1 (never or almost never) to 4 (always or almost always).

We also used the following measures in construct validity tests: satisfaction with life scale, a 5-item scale rated from 1 (strongly disagree) to 7 (strongly agree), which has a high reliability (α > 0.80 in 3 studies); self-reported health measured by the first question of the SF-36 (“In general, do you think your health is...,” rated from 1 (excellent) to 5 (poor)); and self-esteem, measured by a single item (“I have a high self-esteem”) rated from 1 (strongly disagree) to 5 (strongly agree). Both the self-reported health and the self-esteem single-item measures have good construct validity as self-reported health predicts mortality and self-esteem predicts depression and other physical and mental health constructs. Additional variables were related to the professional and sociodemographic status of respondents.

We expected higher regret intensity to be associated with more severe consequences for the patients, and with a stronger feeling of responsibility. However, on the basis of the results of the qualitative study, we hypothesized that regret intensity would not be higher when the event implied an error of the health care professional. We expected regret intensity to be related to lower life satisfaction, lower self-esteem, and poorer self-reported health of the health care professionals. Finally, higher regret intensity should lead to more changes in patient care practices, because health care professionals are presumably motivated to avoid experiencing...
Validation of a Regret Intensity Scale

We ran analyses separately for nurses and physicians to determine whether the scale was appropriate for both professions. However, results were very similar except for construct validity (as expected by our hypotheses). Thus, we present the results on the whole sample, except for construct validity. We studied item characteristics by examining percentage of missing answers and floor or ceiling effects. We explored the number of underlying dimensions of the scale by principal component analysis and exploratory factor analysis. Using item response theory, we then determined for each item its information function (ie, the precision of the item for all levels of the total scale). Items were kept if their information function was high, as well as to present a large range of item difficulties and to represent the affective, physical, and cognitive components of regret. Internal consistency of the total scale and the shortened scale was assessed using Cronbach $\alpha$. Total scores were computed by taking the mean of all items, if at least half of the items were answered (if more than half of the items were missing, the score was coded as missing). Construct validity was assessed by $t$ test for categorical predictors and correlations for continuous predictors.

Test-retest validity was assessed using the 1-month follow-up. Health care professionals who did not report a new major regret-inducing event should have the same level on the RIS. Similarity of measurement was assessed, among health care professionals reporting the same event, using weighted $k$ for single categorical items and intraclass coefficient of correlation for the total score. In addition, scores' variability over time (ie, measurement error) was examined by a Bland-Altman plot of the individual means of RIS-10 scores at baseline and 1-month follow-up versus the differences in the scores. The 95% confidence interval (CI) of the differences provides the limits of agreement. Sensitivity to change was assessed among individuals who did report a new major regret-inducing event, using the absolute value of the difference in scores between baseline and 1-month follow-up.

RESULTS

Study Sample
In total, 469 persons returned the survey (29.9% of the 1571 eligible persons contacted). Of the 311 participants who returned a numbered questionnaire, 250 agreed to participate in the retest and 175 (70.0%) actually returned the 1-month follow-up.

Participants had a mean age of 39.51 (9.16) years. Approximately half were nurses and half were physicians, and most had several years of professional experience. Nurse participants were generally more experienced than physicians. Mean regret intensity was similar for nurses and physicians (Table 1).

Internal Validity
There were between 2.6% and 4.1% missing items. The first component of a principal component analysis of the 19 items explained 61.2% of the variance. Although the eigenvalue for the second factor was slightly above 1, the scree plot clearly favored a 1-factor solution. Of the initial 19 items, 9 were dropped (Table 2), because their information functions (Fig. 1) were low (ie, they were not very informative), because their item difficulties were redundant with other items and/or because their frequency distributions showed that only 1 or 2 answer modalities were used. The 10 retained items cover the affective, physical, and cognitive aspects of the emotion of regret. The internal consistency was 0.90 (nurses: 0.92 and physicians: 0.94) for the 19-item scale and 0.87 (nurses: 0.89 and physicians: 0.92) for the 10-item scale. No significant floor or ceiling effects were observed for the 19-item or the 10-item scale (Table 2).

Construct Validity
Table 3 presents the associations between the 10-item RIS and the consequences of the regret-inducing event on the patient, the health care professional, and patient care. Results for the 19-item scale were very similar (data not shown). Most of the consequences of the event on the patient were associated with the intensity of regret, especially more severe consequences, such as resuscitation or transfer to ICU. Regret intensity was more often associated with consequences for the patient among nurses, in particular when the event led to additional surveillance, intervention, or longer hospitalization.

For both nurses and physicians, regret intensity was not significantly higher for events in which they made an error. However, it was related to feeling responsible for the event, in particular among physicians. Regret intensity was also significantly related to lower life satisfaction and lower self-reported health of the health care professionals, but not to self-esteem.

With respect to self-reported changes of patient care practices, regret intensity was associated with trying to analyze the event and apologizing to the patient or his/her family for nurses but not for physicians. In contrast, regret intensity led physicians to talk to colleagues to improve practices. Regret intensity was not associated with talking to a supervisor to prevent these events from reoccurring for nurses, and this association was significantly negative for physicians. In other words, the higher the regret intensity, the less often physicians talked to their supervisor about the situation, but the more often they talked to their colleagues.

Test-Retest Reliability
Of the 175 participants who responded to the retest survey, 141 referred to the same regret-inducing event and were thus included in the test-retest analysis. Test-retest agreement was acceptable for all 19 items (weighted $k$ range, 0.39–0.65; mean = 0.55). The test-retest agreement for the total score was 0.63 for the 19-item scale (95% CI, 0.52–0.72) and 0.70 for the 10-item scale (95% CI, 0.60–0.77).
The mean difference between scores among health care professionals referring to the same event was very low and nonsignificant (see Bland-Altman plot, Fig. 2). In contrast, the variance was relatively large. A few participants showed a large increase in regret intensity between baseline and 1-month follow-up. In contrast, among health care professionals who did not refer to the same event, the absolute difference in regret intensity was 0.45 points ($P < 0.001$).

**DISCUSSION**

In this study of 469 physicians and nurses, we developed and validated a scale of regret intensity that is applicable to regrets associated with providing health care in the last 5 years. The resulting 10-item scale had very high internal consistency ($\alpha = 0.87$) and measured a single construct. Test-retest reliability was good (intraclass coefficient of correlation for the 10-item scale: 0.70), yet also indicating that regret intensity varies when caregiver recall an event that occurred up to 5 years in the past (as also shown by the Bland-Altman plot). Indeed, a few participants reported a large increase in regret intensity at the 1-month follow-up. This may be due to the survey reawakening memories of a painful event. Further studies using this scale may benefit from informing the health care professionals that

<table>
<thead>
<tr>
<th>TABLE 1. Baseline Characteristics of Health Care Providers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>N = 240</td>
</tr>
<tr>
<td>Sex</td>
</tr>
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<td></td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Professional status</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Percentage of clinical activity</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Years of experience</td>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>RIS-10 (range, 1–5)</td>
</tr>
</tbody>
</table>

RIS-10 indicates 10-item regret intensity scale.

The mean difference between scores among health care professionals referring to the same event was very low and nonsignificant (see Bland-Altman plot, Fig. 2). In contrast, the variance was relatively large. A few participants showed a large increase in regret intensity between baseline and 1-month follow-up. In contrast, among health care professionals who did not refer to the same event, the absolute difference in regret intensity was 0.45 points ($P < 0.001$).

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<table>
<thead>
<tr>
<th>TABLE 2. Item Characteristics of Regret Intensity at First Survey (n = 469)</th>
</tr>
</thead>
<tbody>
<tr>
<td>When I Think About the Event That Caused my Major Regret... % At Lowest Value % At Highest Value Mean (SD) Loading of PCA</td>
</tr>
<tr>
<td>RIS-10</td>
</tr>
<tr>
<td>1. Emotions come back to me</td>
</tr>
<tr>
<td>3. I feel uncomfortable</td>
</tr>
<tr>
<td>4. I feel devalued</td>
</tr>
<tr>
<td>5. I feel ashamed</td>
</tr>
<tr>
<td>7. I have a knot in my stomach</td>
</tr>
<tr>
<td>8. I feel anger rising in me</td>
</tr>
<tr>
<td>10. At home, I have trouble falling asleep</td>
</tr>
<tr>
<td>11. At work, I have trouble concentrating</td>
</tr>
<tr>
<td>12. I have the impression I am not really made for this work anymore</td>
</tr>
<tr>
<td>16. I want to cry</td>
</tr>
<tr>
<td>10-item regret intensity scale</td>
</tr>
<tr>
<td>Additional 9 items of RIS-19</td>
</tr>
<tr>
<td>2. I feel guilty toward the patient</td>
</tr>
<tr>
<td>6. I blame myself</td>
</tr>
<tr>
<td>9. I resent medicine’s lack of power</td>
</tr>
<tr>
<td>13. I resent the institution</td>
</tr>
<tr>
<td>14. I have a lump in my throat</td>
</tr>
<tr>
<td>15. I feel I have betrayed the patient’s trust</td>
</tr>
<tr>
<td>17. I feel I failed my duty as a caregiver</td>
</tr>
<tr>
<td>18. I feel sad</td>
</tr>
<tr>
<td>19. I resent a colleague (or colleagues)</td>
</tr>
<tr>
<td>19-item regret intensity scale</td>
</tr>
</tbody>
</table>

Number left of item description corresponds to the item order in the scale.

PCA indicates principal component analysis; RIS-10, 10-item regret intensity scale.
Validation of a Regret Intensity Scale

As expected, regret intensity was higher when the regret-inducing event had more severe consequences for the patient, such as resuscitation, transfer to ICU, and permanent harm. Interestingly, the consequences of the event seemed less related to regret intensity for physicians than for nurses, in particular longer hospitalization, additional surveillance, and additional intervention.\(^8\)

Regret intensity was positively associated with feeling responsible for the event. However, there was no relationship between regret intensity and making an error (self-reported judgment). This finding is coherent with the literature on stress and locus of control, suggesting that being the initiator of a negative event (ie, controlling an event) is less stressful than suffering the same event without control.\(^31\)–\(^33\) It is also in line with the results of the qualitative study that we

![FIGURE 1. Item information curves for the 19 items of the regret intensity scale. Retained items are in black, dropped items in gray.](image1)

![FIGURE 2. Bland-Altman plot of regret intensity (RIS-10) for the baseline and the 1-month follow-up surveys. RIS-10 indicates 10-item regret intensity scale.](image2)

### TABLE 3. Association of Regret Intensity With the Consequences of the Regret-inducing Event on the Patient, on the Health Care Professional, and on Patient Care

<table>
<thead>
<tr>
<th>Consequences to patient</th>
<th>Nurses N</th>
<th>β</th>
<th>P</th>
<th>Physicians N</th>
<th>β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe discomfort</td>
<td>134</td>
<td>0.06</td>
<td>0.53</td>
<td>120</td>
<td>0.12</td>
<td>0.28</td>
</tr>
<tr>
<td>Severe medical complication</td>
<td>69</td>
<td>0.11</td>
<td>0.28</td>
<td>105</td>
<td>0.13</td>
<td>0.19</td>
</tr>
<tr>
<td>Additional surveillance</td>
<td>119</td>
<td>0.20</td>
<td>0.03</td>
<td>102</td>
<td>0.14</td>
<td>0.18</td>
</tr>
<tr>
<td>Additional intervention</td>
<td>102</td>
<td>0.28</td>
<td>0.002</td>
<td>102</td>
<td>0.23</td>
<td>0.03</td>
</tr>
<tr>
<td>Resuscitation</td>
<td>36</td>
<td>0.33</td>
<td>0.007</td>
<td>54</td>
<td>0.34</td>
<td>0.004</td>
</tr>
<tr>
<td>Longer hospitalization</td>
<td>73</td>
<td>0.29</td>
<td>0.003</td>
<td>86</td>
<td>0.14</td>
<td>0.17</td>
</tr>
<tr>
<td>Transfer to ICU</td>
<td>37</td>
<td>0.45</td>
<td>&lt;0.001</td>
<td>55</td>
<td>0.43</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Permanent harm</td>
<td>62</td>
<td>0.33</td>
<td>0.001</td>
<td>88</td>
<td>0.27</td>
<td>0.01</td>
</tr>
<tr>
<td>Unexpected death</td>
<td>31</td>
<td>0.18</td>
<td>0.15</td>
<td>43</td>
<td>0.14</td>
<td>0.26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Involvement of the health care professional</th>
<th>Nurses N</th>
<th>β</th>
<th>P</th>
<th>Physicians N</th>
<th>β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported error</td>
<td>42</td>
<td>0.03</td>
<td>0.83</td>
<td>96</td>
<td>0.10</td>
<td>0.30</td>
</tr>
<tr>
<td>Responsibility</td>
<td>—</td>
<td>0.14</td>
<td>0.03</td>
<td>—</td>
<td>0.22</td>
<td>0.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consequences to the health care professional</th>
<th>Nurses N</th>
<th>β</th>
<th>P</th>
<th>Physicians N</th>
<th>β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life satisfaction</td>
<td>—</td>
<td>-0.18</td>
<td>0.005</td>
<td>-0.33</td>
<td>—</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>—</td>
<td>-0.10</td>
<td>0.14</td>
<td>-0.12</td>
<td>—</td>
<td>0.08</td>
</tr>
<tr>
<td>Self-reported health</td>
<td>—</td>
<td>0.17</td>
<td>0.01</td>
<td>0.20</td>
<td>—</td>
<td>0.002</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Changes in patient care practices</th>
<th>Nurses N</th>
<th>β</th>
<th>P</th>
<th>Physicians N</th>
<th>β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>I try to analyze the event</td>
<td>—</td>
<td>0.13</td>
<td>0.049</td>
<td>-0.05</td>
<td>—</td>
<td>0.43</td>
</tr>
<tr>
<td>I apologize to the patient (or his family)</td>
<td>—</td>
<td>0.16</td>
<td>0.02</td>
<td>-0.03</td>
<td>—</td>
<td>0.64</td>
</tr>
<tr>
<td>I talk with a supervisor to prevent these events from reoccurring</td>
<td>—</td>
<td>-0.03</td>
<td>0.63</td>
<td>-0.16</td>
<td>—</td>
<td>0.02</td>
</tr>
<tr>
<td>I expose the situation to colleagues to improve our practices</td>
<td>—</td>
<td>0.04</td>
<td>0.58</td>
<td>0.20</td>
<td>—</td>
<td>0.004</td>
</tr>
</tbody>
</table>

\(\beta\) represent mean differences for categorical variables and correlations for continuous variables.

ICU indicates intensive care unit.
conducted in the same hospital, in which nurses reported that some of their most intense regrets stemmed from situations in which physicians made decisions they did not agree with (eg, continuing intervention instead of switching to palliative care). However, making an error could lead to feeling more responsible for the event and thus increase regret intensity. Further research is needed to understand the intricate relationship between medical errors and regret.

As expected, higher regret intensity was related to lower life satisfaction and lower self-reported health. The pattern of results was similar for self-esteem, but in the latter case the association was not significant. Although these associations are not very strong, they concern regret felt for a single past event in relation to the health care professional’s general state. Measuring a large number of regret-inducing events, ideally in a prospective cohort study, may lead to a better estimation of the cumulative impact of regret on physical and mental health.

With respect to patient care practices, for nurses, regret intensity was significantly related to analyzing the event and apologizing to the patient or his family, but not to talking to colleagues or supervisors to change practices. In contrast, for physicians, higher regret intensity was not significantly associated with analyzing the event or apologizing, but was positively related to talking to colleagues to improve practices. In addition, higher regret intensity led to less talking with a supervisor to prevent event reoccurrence. This finding is in line with studies showing that physicians complete fewer incident reports than nurses, in part because they worry about negative consequences, and because they do not receive feedback on the changes implemented after their report. In both cases, physicians may feel that it is either detrimental or not useful to talk to their supervisors.

The main limitation of this study is the percentage of returned surveys (29.9%) that could be a cause of selection bias if the individuals who did not answer differed from those who did. In this study, individuals receiving the numbered survey had the opportunity to indicate that they did not want to participate. Of the 1033 eligible participants to the numbered survey, 227 (22.0%, 143 nurses and 84 physicians) sent back an empty survey. This percentage of unwillingness to participate is unusually high and suggests that the low returned survey rate is not due to lack of interest in regret, but rather to the sensitive nature of this topic. If we compute the response rate on the basis of all individuals who sent back the survey (even empty), we would arrive at a response rate of 52.1% (538 of the 1033 eligible participants of the numbered survey), which is in line with more usual response rates to mailed surveys among health care professionals. The number of surveys returned was very similar for physicians and nurses (157 physicians and 147 nurses). Finally, although the return rate may cast doubt on the validity of regret prevalence or mean regret intensity, the association among items and the structure of the scale are less likely to be affected by the selection of the respondents. In contrast, construct validity may be more sensitive to selection bias if both regret intensity and other constructs (eg, self-reported health) were different between nonrespondents and respondents. This possibility could be prevented, in a future prospective study, by recruiting health care professionals before they experience care-related regrets (novice physicians and nurses).

In conclusion, the RIS-10 possesses sound psychometric properties for the study of hospital-based physicians and nurses. Being a short questionnaire, it could also be used to assess regrets repeatedly, by focusing on different time frames for the regret-inducing event (eg, “Thinking back to the event you regretted the most in the last month”). This would allow researchers to examine the impact of evolving practice conditions (eg, less supervision) or the adaptation of health care professionals to a new ward.

REFERENCES

Validation of the German version of two scales (RIS, RCS-HCP) for measuring regret associated with providing healthcare

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Abstract

Background: The regret intensity scale (RIS) and the regret coping scale for healthcare professionals (RCS-HCP) working in hospitals assess the experience of care-related regrets and how healthcare professionals deal with these negative events. The aim of this study was to validate a German version of the RIS and the RCS-HCP.

Methods: The RIS and RCS-HCP in German were first translated into German (forward- and backward translations) and then pretested with 16 German-speaking healthcare professionals. Finally, two surveys (test and 1-month retest) administered the scales to a large sample of healthcare professionals from two different hospitals.

Results: Of the 2142 eligible healthcare professionals, 494 (23.1%) individuals (108 physicians) completed the cross-sectional web based survey and 244 completed the retest questionnaire. Participants (n = 165, 33.4% of the total sample) who reported not having experienced a regret in the last 5 years, had significantly more days of sick leave during the last 6 months. These participants were excluded from the subsequent analyses. The structure of the scales was similar to the French version with a single dimension for the regret intensity scale (Cronbach’s alpha: 0.88) and three types of coping strategies for the regret coping scale (alphas: 0.69 for problem-focused strategies, 0.67 for adaptive strategies and 0.86 for the maladaptive strategies). Construct validity was good and reproduced the findings of the French study, namely that higher regret intensity was associated with situations that entailed more consequences for the patients. Furthermore, higher regret intensity and more frequent use of maladaptive strategies were associated with more sleep difficulties and less work satisfaction.

Conclusions: The German RIS and RCS-HCP scales were found valid for measuring regret intensity and regret coping in a population of healthcare professionals working in a hospital. Reporting no regret, which corresponds to the coping strategy of suppression, seems to be a maladaptive strategy because it was associated with more frequent sick days.

Keywords: Regret, Validation, Translation, Healthcare professionals, Psychometrics, Switzerland, Days of work absence

Background

Healthcare professionals are increasingly providing care to complex patients of older age, with multiple comorbidities [1] and from various cultural origins. How healthcare professionals respond to disparate groups of patients is a challenge, as well as how they deal with the contradictory needs of being empathic clinicians and dealing with the emotional burden of patients’ suffering, complications, or death [2]. Providing patient-centered and family-focused care implies more challenging medical and clinical decisions and the risk for unsatisfactory patient outcomes is greater, thereby generating strong negative emotions among healthcare professionals, such as ‘stress of consciences’ [3], moral distress [4], or feelings of loss of control [5].

Regret is a frequent emotional experience, which may be defined as a psychological state following an experience where one believes that the outcome would have been better if one had acted differently [6]. Regret
develops in situations where healthcare professionals cannot fulfill what they believe to be the optimal care for their patients. In a cross-sectional survey of healthcare professionals in Switzerland, the prevalence of regret in a one-month period was 15% among nurses and 10% among physicians [7]. To cope with feelings of regret, people may use various strategies: the main distinction among coping strategies is problem-focused versus emotion-focused [8, 9]. Problem-focused coping strategies are directed towards reducing or eliminating a stressor or solving the situation, whereas emotion-focused coping strategies are directed towards changing one’s own emotional reaction to the situation.

Regret in the healthcare setting occurs mainly when clinicians perceive their care as inappropriate [10] or futile [11], and in the context of defensive medicine [12]. Regrets also occur when clinicians are implicated in patient-adverse events or medical errors [13]. “Second victim” experiences are closely related to regret feelings [14, 15]. The consequences of these strong feelings manifest themselves at different levels. At the individual level, regret can lead to sleep problems [16–20], which can result in concentration deficits and higher risk of errors [21] or contribute to burnout [22]. At the patient-care level, regret can affect decision making [23], as well as learning and changing practice for future interventions [24–26], and again is associated with higher risk of error [16]. The decision-making process, especially in situations associated with a high workload, can trigger a variety of emotional reactions [27]. For example, anticipated regret is known to play a substantial role when physicians favor action (e.g., additional diagnostic tests) instead of inaction [24, 28]. At the institutional level, distress may increase turnover of staff members and days of sick leaves [29, 30].

Healthcare professionals’ emotional reactions have increasingly attracted scientific attention over the last decade [31–33]. However, there is a lack of valid instruments to measure regret intensity and regret regulation strategies in healthcare professionals [34], although regret can be conceptually quantified by the intensity of the emotion and coping can be assessed by the frequency of use of the various strategies [13, 35]. Such instruments should cover the main dimensions of emotion and emotion regulation, and should be reliable yet short, in order to allow monitoring regret at regular intervals. Two French speaking scales measuring regret intensity [36] and coping strategies [7] fulfill these requirements. Thus, the aim of this study is to translate and validate a German version of the Regret Intensity Scale (RIS) and the Regret Coping Scale of Health Care Professionals (RCS-HCP) [7, 36], developed in Switzerland.

Methods
Design
The steps to validate the RIS and RCS-HCP in German were first to contact two healthcare professionals in the German-speaking part of Switzerland (one physician, one psychotherapist) and to assess the conceptual validity of the scales in their cultural context. The scales were then translated, and pretested among German-speaking healthcare professionals. The final step was to use two surveys (test and retest) to administer the scales to a large sample of healthcare professionals from two different hospitals. The Ethics Committee of Zurich indicated that the research was exempted from formal research ethics approval because, as declared by Swiss law, it did not study a disease and did not use an intervention on health.

Scale translation
Two professional translators with expertise in the field of healthcare independently performed the translation of the two scales and the validation questions from French to German (forward translation). Then, two native French translators independently translated the German version back into French (backward translation). The backward translators were unaware of the original scales in French. A group of experts including three native German speakers and three native French speakers (two psychologists, three physicians and one medical sociologist) examined the translated items and selected the best translation for each item after the forward translation and after the backward translation.

Pretest
The first German versions of the Regret Intensity Scale (RIS) and Regret Regulation Scale (RCS-HCP) were pretested using one-on-one structured interviews by one interviewer at Stadtpital Triemli among 7 nurses, 8 doctors and 1 psychologist from a variety of clinics. The objective was to ensure that the translated items were clear and understandable for different professionals. During this process, 3 successive small adaptations and new versions of the questionnaire were made (see Additional file 1 for the final versions of these scales). There were no suggestions about additional domains that should be assessed.

Participants of the main survey
All professional email addresses of nurses and physicians of the Stadtpital Triemli, Zurich (500 bed hospital) and the Bezirksspital Affoltern am Albis (100 bed hospital) were collected. The participants, coming from all different departments and clinics, were informed by posters and flyers one week before the email was sent. Participants were informed that a small incentive for each completed questionnaire will be donated to the
foundation Theodora (Giggle doctors for children: http://ch.theodora.org). The inclusion criteria were healthcare professionals currently working with patients; the exclusion criteria were professionals not having worked with patients for at least 5 years or retired.

**Sample size calculation**

To determine sample size, we used the rule of 10 respondents per 1 item [37]. A subject to item ratio of 10 was an adequate compromise between goodness quality of factor analysis estimation (supposing large samples), the low and declining participation rates of healthcare professionals in surveys [23] and the small size of the two hospitals where the survey was conducted. Considering that the longest scale (RCS-HCP) has 15 items, 150 respondents were required. In order to be able to examine the psychometric properties of the scales separately among nurses and physicians, the minimum sample size was fixed at 300 (150 physicians, 150 other professionals).

**Procedure**

After the pretest of the translated questionnaire a cross-sectional survey with a web questionnaire was conducted. Up to three reminders were sent to the professional email addresses at a one-week interval. One month later the same questionnaire was sent to the participants who accepted to receive the retest.

**Measurements**

The questionnaire sent to all the participants contained, after an introduction and clear definition of the term regret, a single question about the most important regret, 6 questions about the consequences for the patient of the regretted situation (whether the regretted situation led to death, longer hospital stay, transfer to intensive care unit (ICU), extra surveillance, reanimation measures or durable physical or psychological handicap). There was also a single question about how much the respondent felt responsible for the situation (visual analogue scale from 0, Not at all, to 10, Very Responsible) and a question about whether the respondent felt this situation was an error (yes vs no). Regret intensity was measured by the German version of the regret intensity scale (RIS; 10 statements rated from strongly disagree (1) to strongly agree (5), which showed a good reliability with a Cronbach's alpha = 0.87 in the French version). Regret coping strategies were measured by the German version of the regret coping scale for healthcare professionals [RCS-HCP; 15 statements rated from never or almost never (1) to always or almost always (4)]. This scale examines three types of coping strategies: problem-focused, maladaptive emotion-focused (self-attacking and rumination), and adaptive emotion-focused (all other strategies, considered as potentially helpful). All subscales measuring coping strategies showed good reliability in the French version, respectively 0.89, 0.89, and 0.89.

To assess construct validity, the insomnia severity index, the general job satisfaction scale and a general self-rated health question were added. The insomnia severity index (ISI) consists of 7 items rated from 0 to 4 (total score range: 0–28), with a higher score indicating more insomnia symptoms, with good alpha = 0.80. In a community sample, a threshold at 10 discriminated well between people with and without insomnia (as evaluated by a clinical interview) and the minimal important difference was 1.5 [38]. The general job satisfaction scale consists of 5 items on a 7-point scale [score ranging from Low (1) to High (7)] with a relatively low Cronbach's alpha 0.61 [39]. The general self-rated health question corresponds to the first question from the SF-36 questionnaire, and has good criterion validity as it predicts mortality [40]. At the end of the survey, information on the socio-demographic and professional status of the participants were collected.

**Statistical analyses**

Participants who reported not having experienced a regret in the last 5 years were excluded from the analysis. Analyses related to the structure of the questionnaires were first run separately for physicians and nurses. Because the results were similar, analyses were then reported for the whole sample. For each item of the RIS and RCS-HCP, the percentage of the lowest and highest value was described. For each scale, we used principal component analysis to examine the number of underlying dimensions of the scale. If the scale had more than one component, we used exploratory factor analysis to obtain factor loadings and determine which items belong to which subscales. Analyses using item response theory for polytomous items (graded response model) supported the results of the factor analyses. The structure of the scales was also confirmed using confirmatory factor analysis, and reporting the recommended goodness-of-fit criteria and threshold: Chisquare/degrees of freedom ($\chi^2$/df) should be <3, RMSEA should be <0.8, SRMR should be <0.10, and CFI should be >0.95 [41]. For each subscale, reliability was estimated using Cronbach's alpha. Test-retest reliability was estimated using weighted kappa for items and intra-class correlation (ICC2) for total scores. In addition, for the RIS and the three coping strategies scores, their variability over time (i.e., measurement error) was examined by a Bland-Altman plot of the participants means at baseline and 1-month follow-up versus the differences in the scores [42]. The agreement interval of the differences provides the limits of agreement. At the end, construct validity was examined using correlations.
between continuous variables and t-tests when the construct validity variables were dichotomous. Analyses were done using R v3.3.1 (R foundation, Vienna, Austria).

Results

Sample characteristics

Of 2196 participants who received an email invitation, 54 were excluded because they reported not working with patients for the last five years or being out of work, a further 148 refused to participate, and 1500 did not answer. Of the remaining 494 (23.1%) participants, 369 (74.7%) agreed to be contacted after one month, and 244 (66.1%) completed the questionnaire a second time.

The mean age of the participants was 39.1 years (SD = 10.2). The majority were women (81.8%), around one fourth of the respondents were physicians (21.9%). Professions other than medical doctors were grouped together for simplicity and because very few participants had a profession other than nurse or physician. Most employees worked at 80% or more. With respect to their health status, more than 25% of the healthcare professionals reported at least one sick leave day in the last 6 months, and 5% of the participants considered their health status as fair or poor. Healthcare professionals reported average levels of regret intensity (mean = 2.04, SD = 0.78, range =1-5) under the scale midpoints. For the coping strategies (range 1–4) they reported average levels of adaptive strategies (mean = 2.59, SD = 0.57) and problem-focused strategies (mean = 2.83, SD = 0.61) above the scale midpoints. Conversely, maladaptive strategies (mean = 1.78, SD = 0.63) were slightly under the scale midpoints.

Of the 494 participants, 165 (33.4%) reported not having experienced a regret in the last 5 years (Table 1). When compared with the participants reporting regrets, those reporting no regret were similar in terms of demographic characteristics (age, gender), as well as in job characteristics (clinical activity percentage, supervisor status and night-shift load). However, a significantly larger proportion of participants reporting no regret were non-physicians, and had between 6 and 10 years of experience. Furthermore, respondents reporting no regret indicated more often having had >3 days of sick leave during the last 6 months. This increased proportion of persons with a sick leave >3 days among healthcare professionals reporting no regret was similar for physicians and for non-physicians, though the smaller sample size did not allow for significant associations within professions. Indeed, among physicians, the proportion of sick leave was 1.1% when the reported at least one regret and 10.5% when they reported no regret ($p = 0.06$). Among non-physicians, these proportions were 6.0% versus 10.1%, respectively ($p = 0.16$).

Internal validity

Similarly to the French version, the principal component analysis of the regret intensity scale found a single component with all loadings above 0.40 (Table 2). The item with the lowest loading was “I feel anger rising in me” (“steigt Wut in mir auf.”). Confirmatory factor analysis showed a good fit of the model to the data: $\chi^2$/df = 2.3, RMSEA = 0.07 (95% confidence interval: 0.06–0.08), SRMR = 0.07, CFI = 0.95. The Cronbach’s alpha was 0.88. The RIS, and the three RCS-HCP scores did not show any floor or ceiling effect.

With respect to the regret coping scale, the principal component analysis suggested 3 components based on Kaiser’s criterion and the screeplot. The loadings of the 3-factor structure reproduced the structure of the French version of the scales, with 5 items measuring problem-focused strategies, 5 items measuring emotion-focused strategies that are mostly maladaptive, and 5 items measuring adaptive emotion-focused strategies (Table 3). Confirmatory factor analysis showed an acceptable fit of the model to the data: $\chi^2$/df = 2.1, RMSEA = 0.06 (95% confidence interval: 0.05–0.07), SRMR = 0.06, CFI = 0.96. The Cronbach’s alpha was 0.69 for problem-focused, 0.86 for maladaptive, and 0.67 for adaptive strategies.

Construct validity

Table 4 presents the association of regret intensity with the consequences of the regret-inducing event. Perceived regret intensity was associated with the consequences for the patient and with patients’ unexpected death or death earlier than expected. Furthermore, regret intensity was higher when healthcare professionals felt more responsible for the situation. It was also associated with lower job satisfaction, more sleep problems and lower self-reported health.

With respect to regret coping strategies, problem-focused strategies were more frequent among supervisors (mean difference: 0.23, $p = 0.002$). Table 5 shows the association of regret coping strategies with healthcare professionals’ characteristics. There was a positive association between the intensity of the most regretted situation and the use of maladaptive strategies. Satisfaction with work was positively associated with the use of problem-focused and of adaptive strategies and negatively with the use of maladaptive strategies. Sleep problems were associated with more frequent use of maladaptive strategies, and, marginally, with less frequent use of problem-focused strategies. Finally, self-reported health was better among healthcare professionals who more frequently used adaptive strategies.
Test-retest reliability

For the test-retest results of the regret intensity scale, the participants who referred to a different regret-inducing event between the test and the retest were excluded. The intensity scale and the coping scale showed similar values across the two surveys with ICC ranging between 0.36 and 0.50 for the items of the RIS, and 0.36 and 0.63 for the items of the 3 coping subscales. The ICC of the overall scales were 0.52 for the RIS, and 0.68, 0.72, 0.60 for the problem-focused (PF), maladaptive (MA) and adaptive scales (A), respectively.

The Bland-Altman figures (Figs. 1, 2, 3 and 4) for the baseline and the 1-month follow-up for regret intensity and the 3 regret coping strategies showed a good stability over time, with only a few healthcare professionals having a large change between baseline and follow-up, irrespective of the initial level.

### Table 1 Comparison of healthcare professionals’ characteristics between participants who reported at least one regret and participants who reported having never had a regret during the 5 last years

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No regret (N = 165)</th>
<th>At least 1 regret (N = 329)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>34 (21.7%)</td>
<td>56 (18.1%)</td>
<td>0.24</td>
</tr>
<tr>
<td>31–39</td>
<td>61 (38.9%)</td>
<td>101 (32.7%)</td>
<td></td>
</tr>
<tr>
<td>40–49</td>
<td>39 (24.8%)</td>
<td>90 (29.1%)</td>
<td></td>
</tr>
<tr>
<td>&gt;50</td>
<td>23 (14.6%)</td>
<td>62 (20.1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woman</td>
<td>138 (83.6%)</td>
<td>266 (80.9%)</td>
<td>0.52</td>
</tr>
<tr>
<td>Man</td>
<td>27 (16.4%)</td>
<td>63 (19.1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Profession</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non Physicians</td>
<td>138 (87.9%)</td>
<td>217 (70.9%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Physicians</td>
<td>19 (12.1%)</td>
<td>89 (29.1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Professional status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse/resident</td>
<td>115 (74.2%)</td>
<td>201 (66.8%)</td>
<td>0.13</td>
</tr>
<tr>
<td>Supervisor</td>
<td>40 (25.8%)</td>
<td>100 (33.2%)</td>
<td></td>
</tr>
<tr>
<td><strong>Percentage of clinical activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–50%</td>
<td>14 (9.0%)</td>
<td>22 (7.1%)</td>
<td>0.76</td>
</tr>
<tr>
<td>51–80%</td>
<td>41 (26.3%)</td>
<td>85 (27.4%)</td>
<td></td>
</tr>
<tr>
<td>81–100%</td>
<td>101 (64.7%)</td>
<td>203 (65.5%)</td>
<td></td>
</tr>
<tr>
<td><strong>Years of Experience</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–2</td>
<td>8 (5.2%)</td>
<td>24 (7.9%)</td>
<td>0.002</td>
</tr>
<tr>
<td>3–5</td>
<td>14 (9.1%)</td>
<td>41 (13.5%)</td>
<td></td>
</tr>
<tr>
<td>6–10</td>
<td>39 (25.3%)</td>
<td>33 (10.9%)</td>
<td></td>
</tr>
<tr>
<td>11–20</td>
<td>46 (29.9%)</td>
<td>109 (36.0%)</td>
<td></td>
</tr>
<tr>
<td>&gt;20</td>
<td>47 (30.5%)</td>
<td>96 (31.7%)</td>
<td></td>
</tr>
<tr>
<td><strong>Nightshifts during last month</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>75 (48.1%)</td>
<td>143 (45.8%)</td>
<td>0.52</td>
</tr>
<tr>
<td>1–3</td>
<td>26 (16.7%)</td>
<td>48 (15.4%)</td>
<td></td>
</tr>
<tr>
<td>4–6</td>
<td>36 (23.1%)</td>
<td>63 (20.2%)</td>
<td></td>
</tr>
<tr>
<td>7–9</td>
<td>13 (8.3%)</td>
<td>39 (12.5%)</td>
<td></td>
</tr>
<tr>
<td>&gt;9</td>
<td>6 (3.8%)</td>
<td>19 (6.1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Self-reported health</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>25 (15.2%)</td>
<td>63 (19.1%)</td>
<td>0.66</td>
</tr>
<tr>
<td>Very good</td>
<td>70 (42.4%)</td>
<td>132 (40.1%)</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>54 (32.7%)</td>
<td>95 (28.8%)</td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>10 (6.1%)</td>
<td>18 (5.5%)</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>0</td>
<td>1 (0.3%)</td>
<td></td>
</tr>
<tr>
<td><strong>Sick leave during last 6 month</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None – 3 days</td>
<td>143 (89.4%)</td>
<td>295 (94.9%)</td>
<td>0.04</td>
</tr>
<tr>
<td>&gt;3 days</td>
<td>17 (10.6%)</td>
<td>16 (5.1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Scores, mean (SD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job Satisfaction (range 1–7)</td>
<td>4.8 (1.1)</td>
<td>4.7 (1.1)</td>
<td>0.16</td>
</tr>
<tr>
<td>Sleep (range 0–28)</td>
<td>6.4 (4.9)</td>
<td>5.9 (4.9)</td>
<td>0.25</td>
</tr>
</tbody>
</table>

*SD standard deviation*
This study examined the reliability and validity of the German versions of the RIS and RCS-HCP. These instruments were found valid for measuring regret intensity and regret coping in a population of physicians and other healthcare professionals working in a hospital. With respect to the reliability of the instruments, analogous factor structures were obtained with the French and the German versions of the scales. Furthermore, the Cronbach’s alpha of the RIS was good and almost identical to that of the French version (0.88 in this study compared to 0.89 in the French version).

### Table 2  
Item characteristics of regret intensity at first survey (n = 329). Number left of item description corresponds to the item order in the scale

<table>
<thead>
<tr>
<th>RIS-10</th>
<th>% at lowest value</th>
<th>% at highest value</th>
<th>Mean (SD)</th>
<th>Loading of PCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Emotions come back to me</td>
<td>8.0</td>
<td>18.7</td>
<td>3.14 (1.22)</td>
<td>0.63</td>
</tr>
<tr>
<td>2. I feel uncomfortable</td>
<td>14.7</td>
<td>12.2</td>
<td>2.8 (1.23)</td>
<td>0.74</td>
</tr>
<tr>
<td>3. I feel devalued</td>
<td>52.8</td>
<td>4.1</td>
<td>1.88 (1.16)</td>
<td>0.77</td>
</tr>
<tr>
<td>4. I feel ashamed</td>
<td>44.4</td>
<td>7.8</td>
<td>2.17 (1.31)</td>
<td>0.73</td>
</tr>
<tr>
<td>5. I have a knot in my stomach</td>
<td>43.0</td>
<td>6.5</td>
<td>2.19 (1.28)</td>
<td>0.75</td>
</tr>
<tr>
<td>6. I feel anger rising in me</td>
<td>43.6</td>
<td>8.5</td>
<td>2.23 (1.36)</td>
<td>0.46</td>
</tr>
<tr>
<td>7. At home, I have trouble falling asleep</td>
<td>70.0</td>
<td>1.6</td>
<td>1.56 (1.0)</td>
<td>0.62</td>
</tr>
<tr>
<td>8. At work, I have trouble concentrating</td>
<td>74.6</td>
<td>0.3</td>
<td>1.35 (0.70)</td>
<td>0.68</td>
</tr>
<tr>
<td>9. I have the impression I am not really made for this work anymore</td>
<td>68.0</td>
<td>3.4</td>
<td>1.60 (1.06)</td>
<td>0.60</td>
</tr>
<tr>
<td>10. I want to cry</td>
<td>71.7</td>
<td>0.9</td>
<td>1.45 (0.83)</td>
<td>0.68</td>
</tr>
<tr>
<td>10-item regret intensity scale</td>
<td>2.2</td>
<td>0.0</td>
<td>2.0 (0.78)</td>
<td>–</td>
</tr>
</tbody>
</table>

SD standard deviation, PCA Principal Component Analysis

### Table 3  
Item characteristics of regret coping at first survey (n = 329). Number left of item description corresponds to the item order in the scale

<table>
<thead>
<tr>
<th>RCS-HCP</th>
<th>% at lowest value</th>
<th>% at highest value</th>
<th>Mean (SD)</th>
<th>Loading of FA</th>
</tr>
</thead>
<tbody>
<tr>
<td>In general, when I regret events or situations with patients. . . . . . .</td>
<td></td>
<td></td>
<td></td>
<td>PF  MA  A</td>
</tr>
<tr>
<td>1. I talk about it with colleagues, to be listened to or reassured</td>
<td>2.5</td>
<td>34.6</td>
<td>3.04 (0.84)</td>
<td>0.51</td>
</tr>
<tr>
<td>2. I discuss the problem again with the patient (or his family)</td>
<td>22.8</td>
<td>12.7</td>
<td>2.26 (0.95)</td>
<td>0.51</td>
</tr>
<tr>
<td>3. I try to find concrete solutions to the situation</td>
<td>1.94</td>
<td>54.4</td>
<td>3.38 (0.77)</td>
<td>0.50</td>
</tr>
<tr>
<td>4. I talk with a supervisor to prevent these events from recurring</td>
<td>10.1</td>
<td>27.0</td>
<td>2.74 (0.97)</td>
<td>0.63 –0.11</td>
</tr>
<tr>
<td>5. I try to accept the situation</td>
<td>4.8</td>
<td>28.3</td>
<td>2.94 (0.85)</td>
<td>0.11 0.49</td>
</tr>
<tr>
<td>6. I think I am no good</td>
<td>41.6</td>
<td>2.6</td>
<td>1.77 (0.78)</td>
<td>–0.12 0.55</td>
</tr>
<tr>
<td>7. I turn these situations in my head all the time</td>
<td>38.3</td>
<td>4.2</td>
<td>1.84 (0.81)</td>
<td>0.85</td>
</tr>
<tr>
<td>8. I think about it so much that it becomes invasive</td>
<td>61.1</td>
<td>2.6</td>
<td>1.52 (0.75)</td>
<td>0.79</td>
</tr>
<tr>
<td>9. I have a tendency to blame myself</td>
<td>17.0</td>
<td>10.2</td>
<td>2.24 (0.85)</td>
<td>0.70</td>
</tr>
<tr>
<td>10. I tell myself that error is human</td>
<td>13.7</td>
<td>11.5</td>
<td>2.41 (0.86)</td>
<td>0.63</td>
</tr>
<tr>
<td>11. I try to take some emotional distance</td>
<td>4.5</td>
<td>23.0</td>
<td>2.84 (0.83)</td>
<td>0.54</td>
</tr>
<tr>
<td>12. I think about this situations all the time</td>
<td>56.9</td>
<td>2.9</td>
<td>1.55 (0.74)</td>
<td>0.82</td>
</tr>
<tr>
<td>13. I expose this situation to colleagues to improve our practices</td>
<td>9.0</td>
<td>23.1</td>
<td>2.74 (0.92)</td>
<td>0.71</td>
</tr>
<tr>
<td>14. I try to see the positive side of things</td>
<td>9.7</td>
<td>17.2</td>
<td>2.60 (0.88)</td>
<td>0.17 0.17 0.60</td>
</tr>
<tr>
<td>15. I try to put the situation in perspective</td>
<td>24.5</td>
<td>6.5</td>
<td>2.15 (0.87)</td>
<td>0.48</td>
</tr>
<tr>
<td>Problem focused</td>
<td>0.3</td>
<td>1.9</td>
<td>2.83 (0.61)</td>
<td>– – –</td>
</tr>
<tr>
<td>Maladaptive</td>
<td>8.3</td>
<td>0.6</td>
<td>1.78 (0.63)</td>
<td>– – –</td>
</tr>
<tr>
<td>Adaptive</td>
<td>0.3</td>
<td>2.6</td>
<td>2.59 (0.57)</td>
<td>– – –</td>
</tr>
</tbody>
</table>

SD standard deviation, PCA Principal Component Analysis, FA factor analysis, PF problem focused, MA maladaptive, A adaptive
Table 4  Association of regret intensity with the consequences of the regret-inducing situation on the patient, on the healthcare professional and on patient care

<table>
<thead>
<tr>
<th>Consequence to patient (e.g., transfer to ICU, resuscitation, permanent harm)</th>
<th>Scale range</th>
<th>Mean difference</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–6</td>
<td>0.24</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Death (unexpected, or expected but earlier)</td>
<td>yes vs. no</td>
<td>0.26</td>
<td>0.04</td>
</tr>
<tr>
<td>Involvement of the healthcare professional</td>
<td>yes vs. no</td>
<td>0.21</td>
<td>0.02</td>
</tr>
<tr>
<td>Responsibility</td>
<td>0–10</td>
<td>Correlation</td>
<td>p</td>
</tr>
<tr>
<td>Consequences to the healthcare professional</td>
<td>1–7</td>
<td>−0.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sleep difficulties</td>
<td>1–28</td>
<td>0.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Self-reported health</td>
<td>1–5</td>
<td>−0.17</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Mean difference for categorical variables and Correlation for continuous variables

However, two dimensions of the regret coping scale had lower Cronbach’s alpha at 0.69 for problem-focused strategies and 0.67 for adaptive coping. This decrease could be due to differences in language and culture, but could also be due to differences in hospital type, because the two German-speaking hospitals included in this study were not teaching hospitals. Regarding linguistic and cultural differences, there were two important differences between the French and the German versions. One concerned the word ‘regret’. In the pretest interviews and in the comments on the survey, the term ‘Gefühl des Bereuens’ (i.e., our translation of regret) was criticized by the respondents as being a word they do not use very often. The German semantics has a more moralizing and judgmental connotation than the English or French word ‘regret’. The other difference concerned the question ‘I feel anger rising in me’, which had a substantially worse loading in the German translation. A hypothesis could be that the valence of anger in the German word ‘Wut’ is more intense or that in German-speaking regions the word ‘Wut’ is less acceptable [43] than the French word ‘colère’.

With respect to construct validity, results were again quite similar to those obtained with the French instruments, showing associations of regret intensity and regret coping with sleep problems, work satisfaction, and self-reported health. Thus, this study provides additional evidence indicating that the experience of intense regrets is associated with poor work satisfaction and more sleeping problems, which could be one reason for the high turnover in healthcare professions [22, 44]. However, the magnitudes of the associations were lower than those found with the French version of the scales, certainly in part due to the lower reliability of the German scales [45].

In addition to the validation of the scales, two results should be noted. First, as in the Geneva sample, about one third of the respondents did not report any regret. Yet, regret is a frequent emotion and is a common experience in healthy individuals [46]. Thus, reporting no regret seems unrealistic, and can be considered as a coping strategy. In this study, however, we found that this strategy (which can be seen as an extreme form of suppression, namely denial) was associated with more sick-day leaves, and, albeit non-significantly, with more sleeping problems [17, 20]. This suggests that denial of regrets is a maladaptive strategy of coping with this experience, though it is possible that other factors, such as motivation towards their job, may also influence reporting no regret and health outcomes. A second interesting point was that with increasing regret intensity, people are more likely to use maladaptive coping strategies. This finding suggests that using ineffective coping strategies may happen when the situation experienced exceeds the healthcare professionals’ coping abilities. Thus, providing training in regret coping but also providing support for healthcare professionals who experienced intense distress is of paramount importance for healthcare professionals’ health, job performance, and quality of life.

There are several limitations to this study. First, it is a cross-sectional study, which only allows the estimation of associations but cannot show causality. Second, the
Fig. 1 Bland-Altman plot of regret intensity (RIS-10) for the baseline and the 1-month follow-up survey.

Fig. 2 Bland-Altman Plot of problem focusing coping strategies RCS-HCP 15 for the baseline and the 1-month follow-up survey.
**Fig. 3** Bland-Altman plot of maladaptive Coping strategies RCS-HCP 15 for the baseline and the 1-month follow-up survey.

**Fig. 4** Bland-Altman plot of adaptive coping strategies RCS-HCP 15 for the baseline and the 1-month follow-up survey.
response rate was low (23.1%), in line with many Internet surveys [47]. Reasons for the low response rate could be the fact that the participants were contacted via their professional email addresses briefly; some professionals were absent during the whole study time (vacation, maternity leave). Another hypothesis is that talking about regrets and emotions in general is a delicate topic for healthcare professionals. While the low response rate should not influence the validation of the scales, it questions the representativeness of the sample and may bias, for instance, the estimation of the prevalence of intense regret. In the same vein, the sample of our study mainly involved women and healthcare professionals other than physicians, and generalizability may thus be compromised. Thus, further studies should aim to obtain a representative sample using other methodologies. Finally, our study validated the instruments in a sample of healthcare professionals who admitted having experienced work-related regret. Since a third of the sample did not admit to feeling regret, a self-report measure cannot assess the intensity of their emotion following a potentially difficult situation. For these healthcare professionals, alternative measures able to detect processes either inaccessible to introspection or that the person might want to conceal may be necessary. Such measures include objective physiological manifestation of distress [48] or implicit measurement procedure [49] based on reaction time to assess automatic associations between regret and work.

Conclusions
The German version of the RIS and RCS-HCP are valid and reliable instruments to assess regret intensity and the use of coping strategies among healthcare professionals working in hospitals. Reporting no regret, which corresponds to the coping strategy of suppression, seems to be a maladaptive strategy because it was associated with more frequent sick day leaves. A practical implication of our study is that it may help evaluate important aspects of emotion regulation that frequently occur in healthcare professional settings. Further studies are needed to develop interventions specifically designed to help healthcare professionals to deal with emotionally challenging work experiences [50, 51].

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Availability of data and materials
The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Authors’ contributions
DSC and SR conceived the research idea and design. All authors contributed for preparing and revising the draft. All authors read and approved the final manuscript.

Competing interests
The authors declare that they have no competing of interests.

Consent for publication
Not applicable.

Ethics approval and consent to participate
The Ethics Committee of Zurich indicated that the research was exempted from formal research ethics approval.

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Additional file
Additional file 1: German version of the RIS and RCS-HCP scales. (DOCOX 61 kb)

Abbreviations
A: Adaptive; CFI: Comparative fit index; df: Degree of freedom; ICC: Intra-class correlation; ICU: Intensive care unit; ISI: Insomnia severity index; MA: Maladaptive; PF: Problem-focused; RCS-HCP: Regret coping scale for healthcare professionals; RIS: Regret intensity scale; RMSEA: Root mean squared error of approximation; SF-36: The short form (36) health survey; SRMR: Standardized root mean residual

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Healthcare-Related Regret among Nurses and Physicians Is Associated with Self-Rated Insomnia Severity: A Cross-Sectional Study

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Abstract

To examine the association between healthcare-related regrets and sleep difficulties among nurses and physicians, we surveyed 240 nurses and 220 physicians at the University Hospitals of Geneva. Regret intensity and regret coping were measured using validated scales. Sleep difficulties were measured using the Insomnia Severity Index (ISI), and an additional question assessed the frequency of sleeping pill use. After controlling for sex, profession, years of experience, rate of employment, and depression as well as for all other regret-related variables, the following variables remained significantly associated with self-rated severity of insomnia: regret intensity (slope = 1.32, p = 0.007, 95%CI: [0.36; 2.29], std. coefficient = 0.16) and maladaptive (e.g., rumination) emotion-focused coping (slope = 1.57, p = 0.002, 95%CI: [0.60; 2.55], std. coefficient = 0.17) remained significant predictors of self-rated insomnia severity. If these cross-sectional associations represent causal effects, the development of regret-management programs may represent a promising approach to mitigating sleep difficulties of healthcare professionals.

Introduction

Sleep difficulties and sleep loss among healthcare providers [1–8] reduce their cognitive abilities [3, 5, 6], and psychomotor performance [4], which can cause medical errors [7]. This empirical evidence concurs with healthcare providers’ self-perception that poor sleep may lead to critical errors at work. In a survey of 150 nurses, 63.5% reported concerns that sleepiness would result in mistakes, and 58.1% worried that sleepiness would cause them to miss changes in patients’ condition [9].
Furthermore, sleep problems are frequent among hospital nurses and physicians. Several studies using the Pittsburgh Sleep Quality Index (PSQI) have shown that around 70% of nurses [9, 10] and 70% of physicians with burnout report poor sleep [11]. Using DSM-IV criteria, one study reported that 18.8% of physicians suffered from insomnia [9, 11].

While sleep is an important problem among healthcare providers [12], the specific causes of poor sleep in this population are complex. Indeed, they are likely numerous and inter-related. Often cited causes of poor sleep among healthcare professionals include night shift work and number of hours worked [2, 9, 13–16]. The associations of sleep problems with healthcare professionals’ psychological and emotional state [9] and with work environment and job strain [17, 18] have also been investigated.

However, to the best of our knowledge, no study has as yet evaluated whether common (non pathological) emotional reactions in healthcare settings, such as regrets, may impact sleep difficulties. Regret may be defined as an affective, cognitive and physiological state following an experience in which one feels that an outcome would have been better if one had acted differently [19]. This emotion is especially likely to occur in medical settings, where healthcare professionals are often required to make speedy and critical decisions on the basis of complex, uncertain, and abundant information [20, 21]. Upon reflection, healthcare decisions and actions are sometimes perceived as inappropriate [22]. Since healthcare professionals are obliged to make a large number of decisions on a daily basis, they are prone to experiencing more regrets than members of other professions. Thus, examining the association between regrets and sleep in healthcare professions is particularly relevant.

The intensity of regret and the strategies used to regulate regret have been associated with poor sleep in both young [23], and older adults [24], and experimental activation of regret has been shown to delay sleep onset [25]. Courvoisier, Merglen [26] proposed that three distinct aspects of regret may influence sleep among healthcare professionals: the intensity of the most important regret, the accumulation of small regrets, and regret regulation strategies.

The aim of the present study was to investigate the association of healthcare-related regret intensity and regret regulation strategies with sleep quality among physicians and nurses. We hypothesized that (a) the intensity of the most important healthcare-related regret, (b) the number of recently experienced regrets, and (c) the use of maladaptive regret regulation strategies (e.g., self-blame) would be associated with sleep problems.

Methods

Study design

We conducted a cross-sectional study of physicians and nurses working at the University Hospitals of Geneva, a Swiss public teaching hospital network including acute and primary care, psychiatric and geriatric facilities with approximately 1900 beds. In 2011, we mailed a paper questionnaire to 1650 randomly selected healthcare professionals (825 nurses and 825 physicians), with up to 3 reminders. Questionnaires were anonymous and sent back by postal mail with no return address. The questionnaire included measures of regret, depression, and insomnia severity, as well as questions about demographics and job characteristics. Exclusion criteria were (a) not working with patients for the last 5 years, (b) recent retirement, or (c) not being a physician or a nurse. The study was approved by the Research Ethics Committee of the University Hospitals of Geneva.

Instruments and measures

Regret. Healthcare-related regret intensity was assessed with the 10-item regret intensity scale (RIS–10) [27]. The RIS–10 examines the intensity of regret at the moment of measurement.
for an event that occurred up to five years in the past using a five-point Likert scale ranging from 'not at all' to 'absolutely'. Respondents are instructed to choose this event based on the intensity of regret at the time of measurement. Healthcare-related regret regulation was assessed with the 15-item regret coping scale (RCS-HCP)[28]. Using a four-point Likert scale (‘never or almost never’, ‘sometimes’, ‘often’, and ‘always or almost always’), the RCS-HCP measures how frequently the respondent uses three types of regret regulation strategies: problem-focused strategies (e.g., talking to colleagues in order to change practices), and emotion-focused strategies, which can be either adaptive (e.g., acceptance of one’s limitations) or maladaptive (e.g., self-blame). The RIS–10 and the RCS-HCP show good psychometric properties, with internal consistency >0.85 (Cronbach alpha) and test-retest reliability >0.70 (Intra-class correlation 2). The validity of these two scales was considered good since the scales were developed based on a qualitative study of physicians and nurses [29], and a panel of experts, including psychologists, one sociologist, and physicians, ascertained that the scales covered all major aspects of regret intensity and regret coping.

We included additional questions about different aspects of the regret-inducing event:

- “How responsible do you feel of this situation?”: answer options ranged from 0 (no responsibility) to 10 (very high responsibility).
- “Did the regret-inducing event imply an error on your part?”: yes or no.
- “How much support did you receive from your superior?”: Answers options ranged from 0 (none) to 10 (high).

In addition, accumulation of regrets was measured using two questions:

- Regret frequency during the last month: “Within these last 30 days, how many situations with patients have you regretted?”
- Regret intensity during the last month: “What is the mean intensity you would give to these situations within the last 30 days?” Answers ranged from 0 (no intensity) to 10 (highest intensity).

**Sleep.** We assessed sleep problems using the Insomnia Severity Index (ISI), which consists of 7 items rated from 0 (none) to 4 (very much), and yields a total score ranging from 0 to 28. This measure is an index of sleep problems (difficulties initiating and maintaining sleep, early awakenings, satisfaction with current sleep patterns) and the consequences of these problems (interference with daytime functioning, noticeability of impairment to significant others, level of distress caused by the sleep problems) over a one-month interval [30, 31]. The internal consistency of the ISI is at least 0.90 in both a clinical and community samples [32]. Concurrent validity of the ISI has also been demonstrated with other-administered versions of this instrument, polysomnography, and cardiovascular measures [32, 33]. Using a cutoff score of 10 to classify individuals in a community sample as having insomnia (as evaluated by a clinical interview), the ISI has a sensitivity of 86.1% and a specificity of 87.7% [32]. In addition to the ISI, one question examined the frequency of sleeping pill use on a four-point Likert scale (0- ‘not within the last month’, 1- ‘less than once a week’, 2- ‘once or twice per week’, and 3- ‘3 or 4 times a week or more’). Answers were dichotomized (not within the last month vs. once or more often per month).

**Depression.** Depressive symptoms over the last 7 days were measured using the Center for Epidemiologic Studies Depression Scale (CESD–10), a 10-item scale for measuring depressive symptoms in the general population. The measure has been shown to possess good internal consistency (α = 0.85) [34, 35].
Since regret and sleep may be related to professional and demographic characteristics, we also collected information on factors that may act as confounding variables, including sex, profession, years of experience, and rate of employment.

**Analyses**

**Sample size.** To accurately estimate regression coefficients, there should be at least 5 times more events (in this study sleeping pill use) than predictors [36], yielding a minimum of 50 events for our 10 predictors (regret variables and confounders included). Based on an expected proportion of healthcare professionals using sleeping pills of 12%, the required sample size is 417 (50/0.12).

**Statistical analysis.** We used multiple linear regression to estimate slopes and 95% confidence intervals for the association between aspects of regret and insomnia severity as assessed by the continuous ISI score. We used multivariable logistic regression to estimate the odds ratios and 95% confidence intervals for the association between aspects of regret and sleeping pill use. For each aspect of regret, we present the results of uni- and multivariate models adjusting for sex, profession, years of experience, rate of employment, and CES-D score. The covariates used for adjustment were chosen to control for confounding effects. For instance, depression could cause sleep problems and change strategies of regret coping, resulting in a biased estimation of the association between regret and sleep. In addition, we constructed a multivariate linear regression model including all aspects of regret and the covariates listed above. The importance of the influence of the regret variables over and above the covariates was estimated with the $R^2$ change coefficient of determination statistic.

Since, in our previous analysis, regret intensity and regret coping were on average similar across professions [27, 28], we analyzed the association between regret and sleep for the whole sample. However, as a sensitivity analysis, we also ran the analyses separately for each profession (i.e., not adjusting for profession in the model). Results were very similar across nurses and physicians (data not shown).

We plotted the proportion of respondents reporting sleeping pill use more than once in the past month according to the score for regret intensity and the score for maladaptive coping strategies. Statistical analyses were performed using R (v 3.0.1) (R Core Team, 2013).

**Results**

Overall, 240 nurses and 220 physicians returned the survey (31.2% of the 1474 eligible participants). Respondents were on average 39.5 (SD 9.1) years old, and 69.3% were female. Compared to the physicians who participated in the study, the nurses tended to be older and reported more sleep problems and also more frequent use of sleeping pills (Table 1). Among the respondents, 19 (4.1%) did not answer the sleep, regret or depression scales, and were excluded from the analysis.

**Insomnia Severity Index**

A one-unit increase in the intensity of the most important regret in the last five years (range: 1–5) was associated with almost 3 more points in self-rated insomnia severity (ISI range: 0–28) (Table 2). This corresponds to a standardized coefficient of 0.33 (not shown in Table 2). The number of regret-inducing events and the score for maladaptive regret coping strategies were also associated with higher scores of insomnia severity (Table 2). Conversely, higher scores for problem-focused and adaptive regret coping were associated with lower scores of insomnia severity (standardized coefficient of -0.13 and -0.12 respectively). These associations remained significant and of similar strength even after adjusting for depression and socio-professional...
variables (Table 2). Both regret intensity and the use of maladaptive strategies showed a substantial association with insomnia severity, as the $R^2$ change (between a model with only the covariates and a model with the regret variable and the covariates) for regret intensity was 5.1%, and the $R^2$ change for maladaptive strategies was 4.7% (Table 2). Feeling supported by one’s superior when the regretted event occurred was associated with lower insomnia severity, but feeling responsible for a regret-eliciting event or reporting that this event was related to a medical error were not.

In a multivariable model including all aspects of regret (i.e. regret intensity, the three regret coping strategies, number and average intensity of regrets in the last month, responsibility, evaluation of the event as an error and superior support), as well as the potential confounders added in the previous multivariable model (i.e., depression, demographics, and job characteristics), only regret intensity (slope = 1.32, $p = 0.007$, 95%CI: [0.36; 2.29], standardized coefficient = 0.16) and maladaptive regret coping strategies (slope = 1.57, $p = 0.002$, 95%CI: [0.60; 2.55], standardized coefficient = 0.17) remained statistically significant predictors of insomnia severity.
Sleeping Pill Use

As expected, respondents who reported using sleeping pills at least once in the prior month also reported more sleep problems (mean ISI score for people using sleeping pills more than once a month: 13.0 (SD = 5.8), mean ISI for people using sleeping pills less than once a month: 6.1 (SD = 5.2), \( p < 0.001 \)).

We observed a strong association between dimensions of regret and whether the healthcare professional used sleeping pills at least once in the prior month (Table 3). For every one unit increase in the regret intensity score, the odds of reporting sleeping pill use was 2.14 times higher (Fig 1); for every one unit increase in the maladaptive regret coping score, the odds of reporting sleeping pill use was 2.25 times higher (Fig 2). These results remained statistically significant event after adjusting for depression, demographics and job characteristics (Table 3).

### Table 2. Parameter Estimates and 95% Confidence Intervals from Linear Regression Models to Evaluate the Association Between Measures of Regret and Insomnia Severity Index Score.

<table>
<thead>
<tr>
<th></th>
<th>Univariable</th>
<th>Adjusted*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>slope</td>
<td>p</td>
</tr>
<tr>
<td>Regret intensity</td>
<td>2.79</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Regret coping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem-focused</td>
<td>-1.31</td>
<td>0.005</td>
</tr>
<tr>
<td>Adaptive</td>
<td>-1.32</td>
<td>0.009</td>
</tr>
<tr>
<td>Maladaptive</td>
<td>2.94</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of regrets in the last month</td>
<td>0.37</td>
<td>0.002</td>
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<tr>
<td>Mean intensity of regrets in the last month</td>
<td>0.48</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Responsibility</td>
<td>0.06</td>
<td>0.54</td>
</tr>
<tr>
<td>Error</td>
<td>-1.00</td>
<td>0.10</td>
</tr>
<tr>
<td>Superior support</td>
<td>-0.26</td>
<td>0.001</td>
</tr>
<tr>
<td>Profession (ref: nurse)</td>
<td>-2.94</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Adjusted for profession (nurse or physician), sex, years of experience, rate of employment, and CES-D depression score.

doi:10.1371/journal.pone.0139770.t002

### Table 3. Odds Ratios and 95% Confidence Intervals from Logistic Regression Models to Evaluate the Association Between Measures of Regret and Sleeping Pill Use.

<table>
<thead>
<tr>
<th></th>
<th>Univariable</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>p</td>
</tr>
<tr>
<td>Regret intensity</td>
<td>2.14</td>
<td>&lt;0.001</td>
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<tr>
<td>Regret regulation</td>
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<tr>
<td>Problem-focused</td>
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<td>0.44</td>
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<tr>
<td>Adaptive</td>
<td>0.75</td>
<td>0.23</td>
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<tr>
<td>Maladaptive</td>
<td>2.25</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of regrets in the last month</td>
<td>1.16</td>
<td>0.006</td>
</tr>
<tr>
<td>Mean intensity of regrets in the last month</td>
<td>1.07</td>
<td>0.25</td>
</tr>
<tr>
<td>Responsibility</td>
<td>1.06</td>
<td>0.21</td>
</tr>
<tr>
<td>Error</td>
<td>0.99</td>
<td>0.96</td>
</tr>
<tr>
<td>Superior support</td>
<td>1.00</td>
<td>0.93</td>
</tr>
</tbody>
</table>

*Adjusted for profession (nurse or physician), sex, number of years of experience, rate of employment, and CES-D depression score.

doi:10.1371/journal.pone.0139770.t003
There was no statistically significant association between the use of problem-focused and adaptive strategies and sleeping pill use.

In multivariate analyses including all aspects of regret, depression, demographics and job characteristics, there was a 1.76 (95%CI: 1.08; 2.92) times higher odds of sleeping pill use associated with a one unit increase in regret intensity and a 1.14 (95%CI 1.01; 1.29) times higher odds of sleeping pill use associated with a one unit increase in the number of regret-inducing events or episodes of regret in the prior month.

**Discussion**

In this cross-sectional study of 460 physicians and nurses, healthcare-related regret was associated with higher self-rated insomnia severity and sleeping pill use. The intensity of the most important regret in the past five years, the number of regrets, and the use of maladaptive regret regulation strategies were associated with higher levels of self-reported insomnia severity and higher odds of sleeping pill use. These associations remained statistically significant after adjusting for depression, demographics, and job characteristics. However, neither feeling personally responsible for the regret-eliciting event nor connecting this event to a medical error were associated with sleep problems or sleeping pill use, suggesting that the scope of regrets
stretches beyond individual mistakes in medical decisions. In accordance with our proposed theoretical model [26] and our previous qualitative study [29], these results suggest that regret intensity and coping are associated with sleep quality among physicians and nurses. In addition, the findings are consistent with studies indicating that the use of dysfunctional strategies of thought control (e.g., thought suppression) and emotion regulation (e.g., self-blame) may contribute to a state of sleep-interfering cognitive and affective arousal [37]. Other dysfunctional strategies, such as rumination, have been associated with insomnia and more generally with neuroticism [38, 39], which is often higher among individuals with sleep difficulties.

Whereas shiftwork in healthcare settings and its consequences on sleep have been studied extensively [e.g., 2], and pathological emotional states (e.g., burnout [11], anxiety [14]) have also been the focus of much research, there is limited research in recent years on psychological (non pathological) factors associated with sleep in this population. This study suggests that emotion regulation may be strongly associated with healthcare professionals’ sleep, though additional studies are necessary to determine the directionality of the link between regret regulation and sleep. Further research to identify psychological factors and methods of mitigating...
their adverse consequences are warranted because, unlike work-schedule constraints, they represent a more modifiable risk factor for sleep quality. Modifying work-schedule constraints, for instance to introduce aviation industry work-hour restrictions in the medical system, was estimated at more than $1,000,000 per patient life-year saved [40]. The introduction of such restrictions would also entail an increase of 71% in the US physician workforce and a 174% increase in the number of residents [40].

A promising avenue for future research will be to design interventions that encourage the use of functional regret regulation strategies (i.e., problem-focused strategies; adaptive emotion-focused strategies) and to explore their efficacy in randomized-controlled trials. Regarding the especially maladaptive strategy of self-blame or self-attacking, it has previously been suggested [24] that fostering self-compassion [41] and self-forgiveness [42] might be particularly helpful intervention strategies.

Given the cross-sectional design of this study, causal inferences regarding the effects of regret intensity and regulation on sleep remain speculative. It is not clear whether regret impacts sleep or sleep impacts feelings of regret. For instance, sleep problems could lead to more time for ruminations. However, as mentioned earlier, a recent randomized trial found that experimental activation of regrets at bedtime delays sleep onset [25]. But there is also evidence that sleep loss may in turn undermine emotion regulation: For instance, a longitudinal study of 78 medical residents found that sleep loss intensified negative emotions following daytime disruptive events [43]. Taken together, these different lines of research suggest that the relations between sleep and emotion regulation may best be conceptualized as bi-directional [44]. Specifically, the experience of regrets may interfere with sleep and the resulting sleep loss may increase regret intensity and decrease resources needed to regulate regrets in adaptive ways. Moreover, sleep loss may decrease attentional resources [45], thereby increasing the risk of errors.

Finally, two other limitations of our study warrant discussion. First, only 31.2% of the eligible healthcare professionals responded to the survey, potentially due to the sensitive topic of regrettable behavior in healthcare settings [46]. Therefore, there may be selection bias if survey response was related to sleep habits and regrets. However, similar associations have previously been found in a sample of university students who were obliged to return their questionnaires in fulfillment of a course requirement [23]. It is also of note that response rate did not differ by profession. Second, we did not collect data on anxiety. It is difficult to disentangle the fact that people with higher levels of anxiety may be more likely to experience regret and may also be more likely to experience sleep difficulties. Therefore, anxiety may either confound or mediate the association between regret and sleep quality. However, in our analyses, we adjusted for depressive symptoms, an affective state that is more closely related to regret than anxiety [33, 47], and the associations between regret intensity, maladaptive regret regulation, and sleep problems remained statistically significant. Note that depression may also be part of the potential causal pathway between regret and sleep. The associations reported here may thus be underestimated.

In conclusion, we have shown that regret intensity and the use of maladaptive regret regulation strategies are cross-sectionally associated with sleep problems among health care professionals. Whether regret management can be acted upon, so as to limit its impact on sleep and other negative consequences, is an issue worth exploring.

Supporting Information

S1 Data. Codebook for the data. ID. Provides a unique and anonymous ID. SEX: 1 = male, 2 = female. PROF: nurse or physician. EMPLOYLEV: Rate of employment, 1 = 0–50%, 2 = 50–
80%, 3 = 80%-100%. Expcat: Categories of work experience, 1 = <3years, 2 = 3–5 years, 3 = 6–10 years, 4 = 11–20 years, 5 = >20 years. RIS10: regret intensity scale score. PF: problem-focused regret coping strategy score. MA: maladaptive regret coping strategy score. A: adaptive regret coping strategy score. Depression: CES-D score. ISI: insomnia severity index score. Pill: Frequency of pill use in the last month, 0 = <1/month, 1 = /C211/month. RMONTH: number of regret in the last month. RINTEN.MONTH: average intensity of regrets in the last month. RRESPON: "How responsible do you feel of this situation?", 0 = no responsibility to 10 = very high responsibility. RERROR: "Did the regret-inducing event imply an error on your part?", 1 = no, 2 = yes. RSUPPORT: "How much support did you receive from your superior?", 0 = no support to 10 high support.

Author Contributions
Conceived and designed the experiments: DC SC TP TA RS GH. Performed the experiments: DC SC TP TA GH. Analyzed the data: DC SC TP EM MM. Wrote the paper: RS SC EM GH TA MM TP DC.

References


Self-Rated Health and Sick Leave among Nurses and Physicians: The Role of Regret and Coping Strategies in Difficult Care-Related Situations

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Moral distress – such as feeling strong regret over difficult patient situations – is common among nurses and physicians. Regret intensity, as well as the coping strategies used to manage regrets, may also influence the health and sickness absence of healthcare professionals. The objective of this study was to determine if the experience of regret related to difficult care-related situations is associated with poor health and sick leave and if coping strategies mediate these associations. Two cross-sectional surveys were conducted in Switzerland (Geneva, 2011 and Zurich, 2014). Outcomes were self-rated health (SRH) and sick leave in the last 6 months. We examined the associations of regret intensity with the most important care-related regret, number of recent care-related regrets, and coping strategies, using regressions models. Among 775 respondents, most reported very good SRH and 9.7% indicated absence from work during four working days or more. Intensity of the most important regret was associated with poor SRH among nurses and physicians, and with higher sick leave among nurses. Maladaptive emotion-focused strategies were associated with poor SRH among nurses, whereas adaptive emotion-focused strategies were positively associated with higher SRH and lower sick leave among physicians. Because care-related regret is an integral part of clinical practice in acute care hospitals, helping physicians and, especially, nurses to learn how to deal with negative events may yield beneficial consequences at the individual, patient care, and institutional level.

Keywords: self-rated health, sick leave, moral distress, healthcare-related regrets, nurses, physicians

INTRODUCTION

Providing safe and good quality healthcare to patients in acute care settings requires healthy healthcare professionals (such as physicians and nurses) (Rowe and Kidd, 2009; West et al., 2009). Yet, many studies have documented that healthcare professionals’ own health is often far from optimal. Compared to the general population, healthcare professionals more frequently report...
poor self-rated health (SRH) (Knecht et al., 2010; Malinauskiene et al., 2011), sleeping problems or poor sleep quality (Aasa et al., 2005; Hsieh et al., 2011; Bjorvatn et al., 2012; Ghalichi et al., 2013), and suffer more often from depression (Embracio et al., 2012) or burn out (Embracio et al., 2007; Arigoni et al., 2010; Merlani et al., 2011). The economic burden of these health-related problems is high for institutions (Schultz et al., 2009; Letvak et al., 2012).

Similarly, moral distress is also common among healthcare professionals working in acute care situations (Pauly et al., 2009; Sirriyeh et al., 2010; Huffman and Rittenmeyer, 2012; Burston and Tuckett, 2013; Oh and Gastmans, 2015). Moral distress can be related to the healthcare professionals’ negative judgment about the quality of care he/she provided to the patients, such as inappropriate care (Piers et al., 2011), loss of control (Shapiro et al., 2011) or stress of conscience (Glasberg et al., 2008), or to healthcare professionals’ involvement in medical errors (Sirriyeh et al., 2010). One emotional facet of moral distress is the experience of regret (Zeelenberg and Pieters, 2007). Healthcare professionals may regret the care that they provided when they feel that it was inconsistent with their personal beliefs or clinical knowledge (Courvoisier et al., 2011, 2013b). The experience of care-related regret is frequent (Courvoisier et al., 2013a), in part because working in acute care hospitals constrains the way healthcare professionals make clinical decisions and attend to patients’ care. The hospital setting entails high workload (Hugonnet et al., 2007; Weissman et al., 2007), shift work, information overload (Rössler, 2012), and the daily confrontation with numerous complex and uncertain clinical situations (Thompson and Dowding, 2001; Nevalainen et al., 2013). Experiencing regrets, may be associated with poor health conditions among healthcare professionals (Schmidt et al., 2015).

Conceptually, three aspects of care-related regret may influence health: the intensity of the most important regret, the accumulation of small regrets experienced throughout the daily working time, and the strategies used to cope with daily regrets (Figure 1) (Courvoisier et al., 2013b). The strategies can be further categorized into three main types: problem-focused strategies (e.g., talking to the patient), emotion-focused adaptive strategies (e.g., accepting one’s own limitations or the inherent limitations of medicine), and emotion-focused maladaptive strategies (e.g., ruminating the events and possible implications). A systematic review showed that adaptive strategies are frequent when healthcare professionals are facing patient adverse events (Seys et al., 2013). Although adaptive strategies may reduce the burden of regret intensity and regret accumulation on health (DeSteno et al., 2013), no study has yet examined specific mechanisms underlying the associations.

The objectives of the present study conducted among hospital-based nurses and physicians were therefore to assess whether their health conditions (SRH and self-reported absenteeism) are associated with (1) care-related regrets (intensity of most important regret, accumulation of regrets) and regret coping strategies; and (2) to test whether coping strategies mediated the associations between care-related regrets and health conditions.

MATERIALS AND METHODS

Study Design
A first survey was conducted in 2011 at the University Hospitals of Geneva, a 1800-beds Swiss public hospital network. Mail questionnaires were sent to 825 nurses and 825 physicians with up to three reminders. A second survey was conducted in 2014 at the Stadtspital Triemli, Zurich (500-beds hospital) and at the Bezirksspital Affoltern am Albis (100-beds hospital). In this second survey, participants were informed that a small incentive for each completed questionnaire was donated to the Children’s Charity “Theodora” (“Giggle doctors,” Aargau, Switzerland). Physicians or nurses were excluded from these studies if they did not practice in the past 5 years, were retired, or reported the absence of any regrets. The World Medical Association’s Declaration of Helsinki was followed in the conduct of the study. The Research Ethics Committee of the University Hospitals of Geneva and the Ethics Committee Zurich indicated that both surveys were exempted from formal research ethics approval.

Outcomes
SRH was measured by the first question of the Short Form (36) Health Survey. Following the stem “In general, do you think your health is...”, participants were asked to rate their health as bad (1), fair (2), good (3.7), very good (4.5), or excellent (5). This coding scheme (1, 2, 3.7, 4.5, and 5) was used to better capture the underlying health construct, since the magnitudes between the response options are not evenly distributed as an interval variable (Perneger et al., 2013). SRH is regularly used in health surveys because it measures physical, mental, and social dimensions of health (Singh-Manoux et al., 2006; Perruccio et al., 2012), and predicts several health outcomes, such as sick leave (Halford et al., 2012) and mortality (Aichele et al., 2016).

Sick leave was measured with a question asking respondents the number of workdays they missed in the last 6 months, excluding leaves related to pregnancy and maternity. This variable was dichotomized at the 75th percentile for each profession, that is 0 day versus 1 day or more for physicians, and 0–3 days versus 4 or more days for nurses.

Independent Variables
The intensity of the most important care-related regret was assessed with the 10-item regret intensity scale (RIS-10) (Courvoisier et al., 2013a). The regret must be related to providing healthcare to a patient, and experienced less than 5 years ago. Items are assessed with a five-point Likert scale ranging from “not at all” to “absolutely.” The RIS-10 possesses good psychometric properties, with an internal consistency of 0.87 (Cronbach’s alpha) and a test–retest reliability of 0.70. In addition to the RIS-10, one question probed whether the respondent felt that the event eliciting their most important regret was related to an error (“According to you, did this event imply an error on your part” answered yes or no).

Care-related regret coping was assessed with the 15-item regret coping scale (RCS-HCP) (Courvoisier et al., 2014), developed to assess daily coping strategies used by healthcare professionals.
to deal with regrets they feel when providing care to patient. Using a four-point Likert scale ranging from 1 (“never or almost never”) to 4 (“always or almost always”), RCS-HCP measures how frequently the respondent uses the three types of regret regulation strategies: problem-focused strategies, emotion-focused adaptive strategies, and emotion-focused maladaptive strategies. The three subscales of RCS-HCP have good psychometric properties, with internal consistencies close to 0.90 (Cronbach's alpha) and test–retest agreement ranging from 0.78 to 0.82 (Courvoisier et al., 2014).

Recent care-related regrets were assessed using two questions: “Within these last 30 working days, how many situations with patients have you regretted?” and “What is the mean intensity you would give to these situations within the last 30 days?,” on a visual analog scale from 0 to 10. If the respondent reported no regret in the last 30 days, the mean intensity was imputed as 0.

Professional and socio-demographic items were assessed with questions including gender, age, profession (physician or nurse), supervising role (yes, no), years of clinical experience, and percentage of clinical activity (0–50, 51–80, >80%).

**Analysis**

The associations of the three care-related variables (i.e., current intensity of the most important regret in the last 5 years, whether the most important regret was an error, number of recent regrets and regret coping) with SRH were examined using linear regression for the SRH score and logistic regression for sick leave. For each outcome, we ran two types of multivariable models. In the first type, we adjusted the analysis of each variable related to regret with the socio-professional variables: gender, years of experience, professional status, percentage of clinical activity, and linguistic region of the hospital. Age was not included because it was too strongly related with years of experience. In the second type of multivariable models, all variables pertaining to care-related regrets and all socio-professional variables were included. All analyses were conducted separately for nurses and physicians. Mediation analyses were performed using Sobel tests with bootstrap confidence intervals. Specifically, the Sobel test compares the coefficient of each regret variable in a model adjusted for socio-professional variables (the corresponding coefficient is called c) to the coefficient of the same regret variable in the model adjusted for socio-professional variables and a regret coping strategy (the corresponding coefficient is called c'). Mediation analyses tested each dimension of coping separately and the three dimensions together. All analyses were conducted with R (version 3.2.4, Vienna, Austria).

We further conducted two sensitivity analyses. First, we ran the same analyses on all healthcare professionals, without stratifying on profession (nurses and physicians together). Second, we examined others ways to model SRH than as a continuous variable with evenly spaced ratings values (1, 2, 3.7, 4.5, and 5) (Perneger et al., 2013), such as an interval scale or a dichotomized scale between very good or excellent versus less than very good.
RESULTS

Overall, 775 participants returned the survey (22.5% of the 3,452 eligible participants). Healthcare professionals had a mean age of 39.5 (SD: 9.1) years. The majority were women, nurses, and had a percentage of clinical activity between 80 and 100% (Table 1). Mean number of years in clinical practice was 15 (median: 12, SD: 10). Most healthcare professionals reported very good SRH status, physicians more than nurses (p < 0.001). Prolonged sick leaves (≥10 days) were reported by 1.7% of physicians compared to 6.3% of nurses (p < 0.001).

**Care-Related Regret and Health Conditions among Nurses (Table 2)**

Adjusted analyses examining each regret variables separately (i.e., intensity of the most important regret, self-perceived error of the most important regret, number and intensity of recent regrets, regret coping) showed that higher intensity

---

**TABLE 1 | Characteristics of healthcare professionals.**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>Nurses</th>
<th>Physicians</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>N%</td>
<td>N</td>
</tr>
<tr>
<td>Socio-professional:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>64</td>
<td>13.9</td>
<td>138</td>
</tr>
<tr>
<td>Female</td>
<td>398</td>
<td>86.1</td>
<td>171</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>77</td>
<td>16.7</td>
<td>65</td>
</tr>
<tr>
<td>30–39</td>
<td>157</td>
<td>34.0</td>
<td>144</td>
</tr>
<tr>
<td>40–49</td>
<td>133</td>
<td>28.8</td>
<td>69</td>
</tr>
<tr>
<td>&gt;50</td>
<td>95</td>
<td>20.6</td>
<td>28</td>
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<td>Professional status</td>
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</tr>
<tr>
<td>Nurse/resident</td>
<td>395</td>
<td>86.2</td>
<td>141</td>
</tr>
<tr>
<td>Head nurse/board certified</td>
<td>63</td>
<td>13.8</td>
<td>167</td>
</tr>
<tr>
<td>Percentage of clinical activity</td>
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<tr>
<td>0–50%</td>
<td>35</td>
<td>7.5</td>
<td>10</td>
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<tr>
<td>51–80%</td>
<td>174</td>
<td>37.5</td>
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<tr>
<td>81–100%</td>
<td>255</td>
<td>55.0</td>
<td>256</td>
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<tr>
<td>Years of experience</td>
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<tr>
<td>&lt;3</td>
<td>30</td>
<td>6.5</td>
<td>30</td>
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<tr>
<td>3–5</td>
<td>26</td>
<td>5.6</td>
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<tr>
<td>6–10</td>
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<td>11–20</td>
<td>148</td>
<td>32.0</td>
<td>74</td>
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<tr>
<td>&gt;20</td>
<td>185</td>
<td>40.0</td>
<td>42</td>
</tr>
<tr>
<td>Hospital’s linguistic region</td>
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<td></td>
<td></td>
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<tr>
<td>French</td>
<td>249</td>
<td>53.4</td>
<td>220</td>
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<tr>
<td>German</td>
<td>217</td>
<td>46.6</td>
<td>89</td>
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<table>
<thead>
<tr>
<th>Care-related regrets:</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current intensity of the most important regret experienced in the last 5 years (RIS-10)</td>
<td>1.86</td>
<td>0.72</td>
<td>1.81</td>
<td>0.76</td>
</tr>
<tr>
<td>Number of regrets (last month)</td>
<td>2.36</td>
<td>1.50</td>
<td>2.35</td>
<td>2.06</td>
</tr>
<tr>
<td>Mean intensity of regrets (last month)</td>
<td>2.35</td>
<td>2.06</td>
<td>2.36</td>
<td>2.06</td>
</tr>
<tr>
<td>Daily regret coping strategies:</td>
<td>Problem-focused</td>
<td>2.86</td>
<td>0.61</td>
<td>2.95</td>
</tr>
<tr>
<td>(RCS-HCP)</td>
<td>Maladaptive</td>
<td>1.78</td>
<td>0.57</td>
<td>1.87</td>
</tr>
<tr>
<td>Adaptive</td>
<td>2.60</td>
<td>0.54</td>
<td>2.73</td>
<td>0.58</td>
</tr>
<tr>
<td>The most important regret in the last 5 years perceived as an error</td>
<td>119</td>
<td>140</td>
<td>45.9</td>
<td></td>
</tr>
</tbody>
</table>

| Health outcomes:                 |        |     |        |     |
| Self-rated health                |        |     |        |     |
| Bad                              | 1      | 0.2 | 0      | 0.0 |
| Fair                             | 29     | 6.3 | 14     | 4.5 |
| Good                             | 180    | 38.9| 60     | 19.4|
| Very good                       | 173    | 37.4| 124    | 40.1|
| Excellent                       | 80     | 17.3| 111    | 35.9|
| Sick leave                      |        |     |        |     |
| 0 days                          | 301    | 65.3| 239    | 77.4|
| 1–3 days                        | 101    | 21.9| 56     | 18.1|
| 4–5 days                        | 14     | 3.0 | 4      | 1.3 |
| 6–10 days                       | 16     | 3.5 | 5      | 1.6 |
| ≥10 days                        | 29     | 6.3 | 5      | 1.6 |
of the most important regret was associated with poor SRH and sick leave, and that more frequent use of maladaptive coping strategies was associated with poor SRH. Perceiving the most important regret as an error and recent regrets experienced in the previous 30 working days (number of regrets and mean intensity) were not associated with health conditions.

In adjusted models including all regret variables, intensity of the most important regret and more frequent use of maladaptive coping strategies remained associated with poor health conditions. Analysis of the mediation effects of regret coping strategies revealed that maladaptive emotion-focused coping partly mediated the effect of intensity of the most important regret (c–c' estimate: −0.05, bootstrap 95%CI: [−0.10; −0.01]) on SRH only, while problem-focused and adaptive strategies had no mediation effect (Supplementary Material).

### Care-Related Regret and Health Conditions among Physicians (Table 3)

Adjusted analyses examining regret variables separately showed that higher level in intensity of the most important regret and of recent regrets were associated with poor SRH. More frequent use of adaptive coping strategies was associated with good SRH and with lower probability of sick leave, while more frequent use of maladaptive strategies was associated with poor SRH. As in the sample of nurses, perceiving the most important regret as an error was not associated with health conditions.

In adjusted models including all regret variables, only more frequent use of adaptive coping strategies remained associated with health conditions, while factors like intensity of the most important regret and of recent regrets were no longer associated with SRH. Analysis of the mediation effects of regret coping strategies revealed that more frequent use of adaptive emotion-focused strategies had an indirect, protective, effect in three associations: between recent regrets and sick leave (c–c' estimate: −0.58, bootstrap 95%CI: [−2.82; −0.08]) and between the most important regret and SRH (0.08, [0.02; 0.18]) and sick leave (0.08, [0.01; 0.17]) (Supplementary Material).

### Sensitivity Analysis

Analyses without stratifying on profession (nurses and physicians together) yielded similar results. When SRH was dichotomized, the only significant predictors of SRH were adaptive strategies for physicians (OR = 0.64, 95%CI: [0.46; 0.86]) and maladaptive strategies for nurses (OR = 1.42, 95%CI: [1.10; 1.85]). By contrast, when SRH was treated as an interval scale results were similar to the previous ones.

### Table 2 | Association of care-related regret with health conditions among nurses.

<table>
<thead>
<tr>
<th>Self-rated health §</th>
<th>Adjusted analyses, regret variables not included*</th>
<th>Adjusted analyses, all regret variables included*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slope</td>
<td>p</td>
</tr>
<tr>
<td><strong>Most important care-related regret in the last 5 years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current intensity (RIS–10)</td>
<td>−0.19</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Self-perceived error</td>
<td>−0.12</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Recent care-related regrets (last 30 working days)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of regrets</td>
<td>−0.01</td>
<td>0.74</td>
</tr>
<tr>
<td>Mean intensity</td>
<td>−0.04</td>
<td>0.44</td>
</tr>
<tr>
<td><strong>Care-related regret coping (RCS-HCP)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem-focused</td>
<td>−0.03</td>
<td>0.55</td>
</tr>
<tr>
<td>Adaptive emotion-focused</td>
<td>0.04</td>
<td>0.39</td>
</tr>
<tr>
<td>Maladaptive emotion-focused</td>
<td>−0.24</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Sick leave §</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most important care-related regret in the last 5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current intensity (RIS–10)</td>
<td>1.34</td>
<td>0.046</td>
</tr>
<tr>
<td>Self-perceived error</td>
<td>1.14</td>
<td>0.71</td>
</tr>
<tr>
<td>Recent care-related regrets (last 30 working days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of regrets</td>
<td>1.03</td>
<td>0.82</td>
</tr>
<tr>
<td>Mean intensity</td>
<td>1.11</td>
<td>0.46</td>
</tr>
<tr>
<td>Care-related regret coping (RCS-HCP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem-focused</td>
<td>0.96</td>
<td>0.77</td>
</tr>
<tr>
<td>Adaptive emotion-focused</td>
<td>1.12</td>
<td>0.48</td>
</tr>
<tr>
<td>Maladaptive emotion-focused</td>
<td>1.13</td>
<td>0.46</td>
</tr>
</tbody>
</table>

*For gender, years of experience, professional status, percentage of clinical activity, and linguistic region of the hospital.

†Considered as continuous (Perneger et al., 2013): 1 = bad, 2 = fair, 3.7 = good, 4.5 = very good, 5 = excellent.

§In the last 6 months. This variable was dichotomized at the 75th percentile for each profession (4 days or more for nurses and 1 day or more for physicians).
DISCUSSION

The experience of care-related regrets — an emotional facet of moral distress — seems to be an unavoidable corollary of acute care practice, which is characterized by time pressure (Weissman et al., 2007), information overload and the increasing complexity and uncertainty related to patient care (Nevalainen et al., 2013). Moreover, suboptimal regret coping strategies may have a negative impact on clinicians’ health and, eventually, on the quality of care they provide to patients (Rowe and Kidd, 2009; West et al., 2009). The aim of this study was twofold: first, to assess the cross-sectional associations between care-related regret experiences and health conditions; second, to test whether coping strategies mediated the relationships between care-related regrets and health conditions.

Care-Related Regrets

Results revealed that higher level of intensity of the most important regret in the previous 5-years was associated with poor SRH among both nurses and physicians, and with higher sick leave among nurses. In accordance with our proposed theoretical model (Courvoisier et al., 2013b), these findings suggest that lingering feelings of moral distress regarding perceived shortcomings or failures in patient care may impact healthcare professionals’ own health in important ways. These findings are also in line with a recent systematic review pointing out that even if distressing experiences are not very frequent among nurses, their impact can be significant a long time after the event (Oh and Gastmans, 2015), a phenomenon which has previously been labeled “moral residue” (Webster and Baylis, 2000). In contrast, the mean intensity of recent regrets (i.e., within the previous 30 working days) was only associated with poor health among physicians. This result is in line with a so-called “crescendo effect” resulting from repetitive exposure to morally distressing situations with patients (Epstein and Hamric, 2009).

Care-Related Regret Coping Strategies

Our findings showed that maladaptive emotion-focused strategies were associated with poor SRH among nurses. This effect remained significant in the model that included all regret and socio-professional variables, in contrast to the corresponding analyses for physicians. Another difference between nurses and physicians emerged regarding the use of adaptive emotion-focused strategies: while it was positively associated both with higher SRH and lower sick leave among physicians, it was not significantly related to these variables among nurses. The positive association between adaptive regret coping strategy and physicians’ health is in line with a systematic review indicating that medical errors do not only entail negative consequences, but may also result in positive outcomes related to psychological well-being and improved teamwork collaboration (Sirriyah et al., 2009).

<table>
<thead>
<tr>
<th>TABLE 3</th>
<th>Association of care-related regret with health conditions among physicians.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-rated health</strong></td>
<td><strong>Adjusted analyses, regret variables not included</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Slope</strong></td>
</tr>
<tr>
<td>Most important care-related regret in the last 5 years</td>
<td></td>
</tr>
<tr>
<td>Current intensity (RIS-10)</td>
<td>−0.19</td>
</tr>
<tr>
<td>Self-perceived error</td>
<td>0.08</td>
</tr>
<tr>
<td>Recent care-related regrets (last 30 working days)</td>
<td></td>
</tr>
<tr>
<td>Number of regrets</td>
<td>−0.81</td>
</tr>
<tr>
<td>Mean intensity</td>
<td>−0.20</td>
</tr>
<tr>
<td>Care-related regret coping (RCS-HCP)</td>
<td></td>
</tr>
<tr>
<td>Problem-focused</td>
<td>0.02</td>
</tr>
<tr>
<td>Adaptive emotion-focused</td>
<td>0.17</td>
</tr>
<tr>
<td>Maladaptive emotion-focused</td>
<td>−0.12</td>
</tr>
<tr>
<td><strong>Sick leave</strong></td>
<td></td>
</tr>
<tr>
<td>Most important care-related regret in the last 5 years</td>
<td></td>
</tr>
<tr>
<td>Current intensity (RIS-10)</td>
<td>0.97</td>
</tr>
<tr>
<td>Self-perceived error</td>
<td>1.21</td>
</tr>
<tr>
<td>Recent care-related regrets (last 30 working days)</td>
<td></td>
</tr>
<tr>
<td>Number of regrets</td>
<td>3.31</td>
</tr>
<tr>
<td>Mean intensity</td>
<td>1.04</td>
</tr>
<tr>
<td>Care-related regret coping (RCS-HCP)</td>
<td></td>
</tr>
<tr>
<td>Problem-focused</td>
<td>1.06</td>
</tr>
<tr>
<td>Adaptive emotion-focused</td>
<td>0.76</td>
</tr>
<tr>
<td>Maladaptive emotion-focused</td>
<td>1.03</td>
</tr>
</tbody>
</table>

* For gender, years of experience, professional status, percentage of clinical activity, and linguistic region of the hospital.

† Considered as continuous (Permeger et al., 2013): 1 = bad, 2 = fair, 3.7 = good, 4.5 = very good, 5 = excellent.

§ In the last 6 months. This variable was dichotomized at the 75th percentile for each profession (4 days or more for nurses and 1 day or more for physicians).
Interestingly, physicians seem better positioned than nurses to cope with negative events or unsatisfactory patient care quality, perhaps because they feel more in charge of key elements of clinical decision making. Having such efficient coping skills is susceptible to explain, at least in part, why they reported better SRH status and fewer sick leave days, when compared with nurses. An alternative explanation is that it may be more difficult for nurses to take emotional distance because they tend to have more frequent and close interactions with patients at their bedside.

Moreover, recent research suggests that coping strategies are not adaptive or maladaptive per se; rather the adaptiveness depends on the context. For instance, reappraisal may be adaptive when stressors are uncontrollable (when the person can regulate only the self) but maladaptive when stressors can be controlled (when the person can change the situation) (Troy et al., 2013). In situations when nurses have an inferior status in the hospital hierarchy, they may often renounce external problem-focused coping and instead turn to internal emotion-focused strategies, which may prove maladaptive in that they do not improve working conditions.

The Meditational Role of Coping Strategies

Irrespective of the objective incidence of difficult situations, learning how to effectively manage such situations may modulate their impact on one's health. In the clinical context, the use of adaptive and maladaptive coping strategies may help explain why similar distressing experiences occurring in patient care can entail either positive or negative consequences for healthcare professionals' own health (Courvoisier et al., 2011). Among nurses, however, there was no evidence suggesting that problem-focused and adaptive coping strategies mediated the relationship between care-related regrets and SRH.

In contrast, maladaptive coping strategies seemed to mediate the relationship between care-related regrets and SRH, suggesting that nurses' use of maladaptive strategies increases the burden associated with their most important care-related regret. This finding concurs with empirical observations that intense and frequent regrets tend to elicit the use of maladaptive strategies (Sheppes et al., 2011; Courvoisier et al., 2014).

A plausible hypothesis may well be that problem-focused and adaptive strategies are only used up to a certain level of regret; once that level is reached, people typically turn to maladaptive strategies. Nurses' perception that they lack autonomy at work may also be an additional explanatory factor (Papathanassoglou et al., 2012). In contrast, physicians' use of coping strategies mediated the effect of the number of recent healthcare-related regrets on sick leave. The use of adaptive emotion-focused coping strategies mediated the effect of the most important regret on both SRH and sick leave. To sum up, the present study provided only partial evidence for a mediating role of coping strategies, especially among nurses for whom it appears that the coping strategies exert a direct influence on their health. Programs that help healthcare professionals cope with care-related situations, like clinical supervision, debriefings and Balint groups, should be expanded for the benefit of clinicians’ own well-being.

Study Limitations

The strengths of the current study include: (a) a relatively large sample size and recruitment in three hospitals in two different linguistic regions; (b) the use of validated scales; and (c) the inclusion of both nurses and physicians, which increases the generalizability of our results to healthcare professionals working in acute care hospitals. Nevertheless, at least three limitations have to be noted. First, our survey obtained a low response rate. Such response rates are not rare in health services research (McLeod et al., 2013), particularly on sensitive topics, such as distress, but it raises concerns about selection bias when estimating prevalence of health conditions. Despite this limitation on absolute estimates, the associations found in this study are quite congruent with the expected results (e.g., negative association of maladaptive regret coping with health). As a result, it seems rather unlikely that the associations of regret with health that we observed should differ between non-respondents and respondents. Second, because SRH has been shown to vary by race (Landrine et al., 2016), the current results may not generalize to all races. Third, we did not adjust for some potential confounders, including night shifts, a factor that could moderate the association between regret and health. Third, due to the cross-sectional design of this study, we cannot determine the causal nature of the associations between regret and health, although the use of adjustment for socio-professional variables should limit the impact of potential confounds.

CONCLUSION

Because care-related regret is an inevitable part of clinical practice, healthcare professionals need to cope with such negative feelings. When effective, these coping skills may have the potential not only to protect healthcare professionals’ own health, but also to promote better quality of care (Burston and Tuckett, 2013). Our findings suggest that physicians may be better positioned than nurses to effectively cope with negative events, notably those that were causing stronger distress. Helping healthcare professionals, especially nurses, to adopt and implement effective coping strategies in their daily practice may produce beneficial consequences at the individual, patient care, and institutional level.

AUTHOR CONTRIBUTIONS

DC and SC conceived the research idea and design. SC, BC, RS, TA, PC, and DC contributed for preparing and revising the draft. SC, BC, and DC participated in the analysis of the data and were responsible for the preparation of the article.


**Conflict of Interest Statement:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary Material

Self-rated health and sick leave among nurses and physicians: the role of regret in difficult care-related situations

Stéphane Cullati, PhD*1-4, Boris Cheval, PhD*1,2,5, Ralph E. Schmidt, PhD5, Thomas Agoritsas, MD6-8, Pierre Chopard, MD1,2, Delphine S. Courvoisier, PhD1,2

* Both authors contributed equally

Supplementary material

Mediation analyses: the Sobel test compares the coefficient of each regret variable in a model adjusted for socio-professional variables (the corresponding coefficient is called c) to the coefficient of the same regret variable in the model adjusted for socio-professional variables and a regret coping strategy (the corresponding coefficient is called c’).

Table S1. Mediation between care-related regrets and self-rated health$^4$ and sick leave$^8$ in the last 6 months.

<table>
<thead>
<tr>
<th>Mediator</th>
<th>Self-rated health</th>
<th>Sick leave</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>c-c’</td>
<td>Bca 95%CI</td>
</tr>
<tr>
<td><strong>Nurses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RIS PF</td>
<td>0.01</td>
<td>-0.00; 0.03</td>
</tr>
<tr>
<td>RIS A</td>
<td>0.01</td>
<td>-0.01; 0.03</td>
</tr>
<tr>
<td>RIS MA</td>
<td>-0.05*</td>
<td>-0.10; -0.01</td>
</tr>
<tr>
<td>RIS All strategies</td>
<td>-0.05*</td>
<td>-0.10; -0.01</td>
</tr>
<tr>
<td>Recent regrets PF</td>
<td>0.00</td>
<td>-0.00; 0.01</td>
</tr>
<tr>
<td>Recent regrets A</td>
<td>-0.00</td>
<td>-0.01; 0.00</td>
</tr>
<tr>
<td>Recent regrets MA</td>
<td>0.00</td>
<td>-0.01; 0.02</td>
</tr>
<tr>
<td>Recent regrets All strategies</td>
<td>0.00</td>
<td>-0.01; 0.02</td>
</tr>
<tr>
<td>Physicians</td>
<td>PF</td>
<td>0.02</td>
</tr>
<tr>
<td>RIS</td>
<td>A</td>
<td>0.08*</td>
</tr>
<tr>
<td>RIS</td>
<td>MA</td>
<td>-0.01</td>
</tr>
<tr>
<td>RIS</td>
<td>All strategies</td>
<td>-0.03</td>
</tr>
<tr>
<td>Recent regrets</td>
<td>PF</td>
<td>-0.05</td>
</tr>
<tr>
<td>Recent regrets</td>
<td>A</td>
<td>0.04</td>
</tr>
<tr>
<td>Recent regrets</td>
<td>MA</td>
<td>-0.04</td>
</tr>
<tr>
<td>Recent regrets</td>
<td>All strategies</td>
<td>0.07</td>
</tr>
</tbody>
</table>

* means p<0.05.
¶ considered as continuous (Perneger et al. 2013): 1=bad, 2=fair, 3.7=good, 4.5=very good, 5=excellent
§ this variable was dichotomized at the 75th percentile for each profession
Abbreviations: RIS= Most important care-related regret in the last 5 years (RIS-10); Recent regrets = number of care-related regrets in the last 30 working days; PF= problem-focused strategies, A= adaptive emotion-focused strategies, MA= maladaptive emotion-focused strategies. Bca = bias-corrected acceleration 95% confidence intervals
outbreaks, and stated that the vaccine will not be included in the national immunisation programme until other regions or countries start to use it and provide effectiveness data.1

Alongside France and the UK, Spain adds to the list of countries adopting a wait-and-see approach.1 In Spain, not even a rigorous cost-benefit assessment was deemed necessary to support the decision, and some hasty calculations of disability-adjusted life-years have been considered sufficient.2

As in other European countries, the incidence of meningococcal B disease in Spain is at its lowest level in decades.3 However, this incidence is almost the same as that of the meningococcal C disease in 2001, when the conjugate vaccine was introduced in the national immunisation programme in Spain and concomitantly in the UK.4 Furthermore, mortality and morbidity remain stable and unacceptably high for meningococcal B.1 If the same prerequisites we see today had been required for the meningococcal C vaccine, we would no doubt be witnessing children and adolescents die from this disease.

The wait-and-see approach is saving money but costing lives.1

Medical research and students in Latin America

Undergraduate medical students are encouraged to do research to increase the number of future medical researchers and to develop skills and critical thinking. Investing in young undergraduate medical students has great potential to develop medical research in developing countries.5

In Latin America, the outlook is not favourable because of low support from universities and governments, but there are some initiatives to develop research in which students have an important role.

Over the past 10 years, student-led initiatives and medical research from undergraduates have increased. Medical student societies are playing an increasingly important part (table), these organisations have been grouped into associations at a national and regional level, and they lead different activities, such as national and international scientific congresses, where people can present their research and discuss strategies to improve medical research.6

Interestingly, medical students have also developed their own publications (such as ANACEM in Chile; table). These journals are led by students, they follow rigorous editorial standards, and are indexed by students, they follow rigorous editorial standards, and are indexed by students, they follow rigorous editorial standards, and are indexed by students. These publications familiarise students with scientific publishing and train future editors of biomedical journals.1

Initiatives promoted by medical students, such as meetings of student journal editors and multicentre research networks,7,8 create a new generation of young leaders in medical research, organised and used to communicate and collaborate.

The way Latin American medical students have taken an active role in promoting research in their countries is very encouraging and motivating for future generations. This should be supported by governments, universities, and other institutions through training programmes and incentive fundings for research to achieve the expected medical scientific development the region needs.

We declare that we have no conflicts of interest.

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Experiencing regrets in clinical practice

After evaluating a 38-year-old man who had a 2-min sharp chest pain at about dinner time, a resident in internal medicine discharged the patient with careful instructions. Throughout history, clinical examination, and work-up were negative, with no particular red flag. 2 h later, the patient was found dead.
Incidence of oral human papillomavirus infection

Aimée Kreimer and colleagues (Sept 7, p 877)1 report an annual incidence of oral human papillomavirus (HPV) infection of 4·4% in an international cohort of men (aged 18–73 years; n=1626; specimen collection every 6 months). We would like to offer a methodological explanation for the difference between this estimate and our estimate of 12·3% from a cohort in Seattle, WA, USA (aged 18–24 years; n=212; specimen collection every 4 months).3 There are several potential explanations, including differences in study population, sample size, and specimen collection schedule. We suggest that one of the main reasons is the difference in specimen collection method. Kreimer and colleagues measured HPV DNA using an oral rinse and gargle, whereas we used both an oral rinse and gargle and a self-collected swab of the back of the throat. In our paper, we also reported an incidence of 6·3% of oral HPV infection on the basis of the rinse-and-gargle method alone, which is closer to the 4·4% reported by Kreimer and colleagues. Pickard and colleagues’ estimated oral HPV incidence of 5·7 per 1000 person-months using a rinse-and-gargle method in a cohort of male and female US college students followed up for 3 months—corresponding to a 6·8% annual incidence. The similarity between these incidence estimates suggests that, to date, there is little evidence that oral HPV infection risk varies greatly across studies that differ in the composition of their study populations.

We declare that we have no conflicts of interest.

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Correspondence

at home from an aortic dissection. Debriefing with supervisors and peers was helpful, because most admitted they would have done the same. Yet the resident was left with an emotion that lasted for years and haunted many nights: regret.

Such stories are common as clinicians make countless decisions and actions daily, often on the basis of complex and uncertain information, and under severe time pressure.1 Regret is the emotion that occurs when one feels another course of action would have led to a better outcome.2 Although involvement with perceived medical errors is common among medical students and residents,3 regret often stems from decisions and actions unrelated to errors.2,4 The effect of affective processes on health care has received little attention.3 Yet intense or repeated regrets might lead to sleep disorders,4 resulting in increased risk of future errors,3 and can influence decision making—eg, clinicians might order unnecessary tests.3,4

Regret is an unavoidable consequence of clinical practice. Whether its experience produces positive or negative consequences depends on the coping strategies clinicians use. Some strategies can act as powerful incentives to improve patient-centred care and lead to relevant changes in practice.4 By contrast, maladaptive coping strategies, such as suppression and rumination, can lead to sleep disorders, depression, and burnout, as well as to an over-acceptance of potentially preventable mistakes (appendix).3

Clinicians who make a mistake are now sometimes considered as second victims and provided with support to deal with their feelings of inadequacy and regret. We believe that all clinicians should be offered similar support for any decisions and actions that trigger strong negative feelings, even when they involve no medical error. Because prevention is better than cure, the best support could be the implementation of specific training programmes on regret coping strategies to protect clinicians from maladaptive strategies affecting their job and health, as well as to enhance quality improvement efforts.

We declare that we have no conflicts of interest.

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