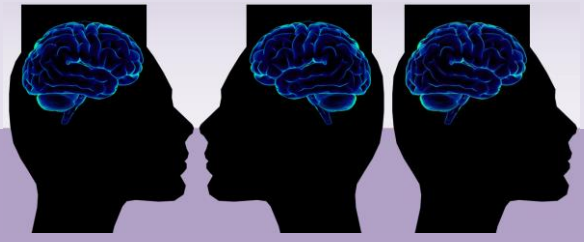
Stress Self-assessment & Questionnaires

choice, application, limits



Philippe Fauquet-Alekhine (ed.)

Preface: Prof. Allan V. Kalueff

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Preface

Many scientists tend to think of 'soft' and 'hard' sciences, based on the respective disciplines' scholarly rigor, quantifiability and objectivity. Understandably so, since scientists always like to cluster and group things. However, the line between these two groups is often rather illusory, and the gap becomes even more narrow in modern days. Is psychology a soft science? “Certainly yes!” - will answer molecular biologists and physicists. “May be not so soft...” - would probably say the readers of “Stress Self-assessment & Questionnaires choice, application, limits” - an excellent book on stress psychology edited by Dr. Philippe Fauquet-Alekhine.

Indeed, the problem of how to objectively quantify - or 'measure' - life and occupational stress remains one of key challenges in today's psychology. Should we trust questionnaires, or simply start recording (and decoding) - empowered by sophisticated computer technologies - human biomarkers, such as body posture, behaviors, facial expression or physiological readouts? The present book, written by a team of international experts - psychologists and medical doctors from Belgium, France, Nederlands, New Zealand and UK - makes a solid attempt at addressing these questions. The topics discussed in this book cover a broad spectrum within stress psychology and physiology, as well as problems of stress management and the existing tools for occupational stress research. Importantly, these book chapters complement each other, working together to provide readers with objective, un-sugarcoated insights into human stress psychology.

Ultimately, this will allow researchers to discover novel associations between environmental factors and physiological phenotypes of stress within an interdisciplinary framework. I hope that the approaches and challenges detailed in this book will aid researchers in achieving this goal, and will also further bridge the 'soft' and the 'hard' sides of human psychology. In addition to experienced investigators, the book will be useful for graduate students, educators, as well as for neuroscientists studying various translational aspects of stress-related behaviors.

Allan V. Kalueff, PhD
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Foreword of the Editor

In May 2015, during the 22nd Conference on "Stress & Behavior" in St-Petersburg (Russia) organized by my dear and esteemed colleague, Professor Allan Kalueff, I had the pleasure of coordinating a round table addressing self-assessment of occupational stress. This topic was initiated after several experiments I undertook in different occupational contexts which led to the assumption that overestimation of perceived stress could occur for high levels of stress. While the scientific literature was void of studies analyzing such a phenomenon, I thought taking the opportunity of an international conference to discuss the question would provide advice or at least examples illustrating a possible difference between self-assessment of stress and an objective way of assessing it. In fact, this was not the case.

Disappointed, I decided to ask researchers attending this conference and involved in studies using questionnaires for stress assessment to join me for the present project: gathering our testimonials in a one-shot journal could contribute towards emphasize a dearth of the literature on the topic. Several agreed. I also contacted other possible contributors all over the world considering their publications. Again, several showed interest for the project.

Then the race began: it was a challenge every week to obtain the provisional title of the papers from the contributors, their bionotes, then the draft paper, organizing the reviewing process and obtaining the corrected proof from the authors.

It was exciting and disappointing at the same time. The disappointment came from the possible contributors dropping out along the way. The excitement came from the contributors who produced papers and followed the project through to the end and brought together interesting scientific testimonials. I hope this collective work will become a relevant basis for the scientific community who may find research questions of interest to be deepened. Despite the fact that some contributors have resigned, here are seven contributions from fourteen authors in five different countries (Belgium, France, The Nederlands, New Zealand and United Kingdom) presenting a short review of available questionnaires scientifically validated for self-assessment of stress (p. 15), an innovative method for in-the-moment assessment of subjective appraisal of a situation (p. 21), examples of successful use of self-assessment questionnaires of stress (p. 36 and 39) and discussions regarding possible bias induced by such questionnaires (p. 15 and 44), a discussion regarding limits of questionnaires for practitioners (p. 51), and a contribution addressing stress management training (p. 56).

These articles are written to be used: feel free to pass on the content of this book.

Finally I would like to warmly thank the contributing authors and especially Laetitia Rouillac from the Lab. for Research in Sc. of Energy for their help, and also my dear colleague Allan Kalueff who unknowingly contributed to the start of this project: without his help for the first round table, the present book would not have been developed.

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Human Factors Consultant, doctor in Physics Science (Un. Paris VI, France), Work Psychologist from the Conservatoire des Arts & Métiers (Paris, France), working on a research project with the Dept. of Social Psychology of the LSE (London, UK), Philippe Fauquet-Alekhine contributes to researches and interventions in firms addressing work activities (learning, simulation training and task performing), work organization and management. His scientific contributions also concern more specific sides as the psycho-linguistic approach for work analysis or operational communication study. Regarding the industrial field, he investigates aerospace, airlines, navy, police, nuclear industry, and medicine.
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His scientific career to date has been that of a psychologist with a strong interest in social psychiatry and psychiatric epidemiology, focusing on the onset, course, and outcome of psychosis. Ulrich was awarded a Ph.D. in Social and Community Psychiatry by Queen Mary University of London in 2011, having previously obtained an MSc in Mental Health Studies at the Institute of Psychiatry, Kings College London, in 2005, and a Diploma in Psychology (Dipl.-Psych.) at the University of Hamburg in 2006. His studies were funded by a scholarship grant by the Evangelisches Studienwerk, Villigst, Germany. Ulrich was formerly a Research Associate at the Department of Psychiatry, University of Cambridge, working on the 10-year MRC funded follow-up of the Aetiology and Ethnicity in Schizophrenia and Other Psychoses (ÆSOP) study, and a Research Fellow at Queen Mary University of London, funded through a doctoral Research Training Fellowship by the National Institute for Health Research (NIHR), UK. The research he currently conducts as part of his NIHR Postdoctoral Research Fellowship at the Institute of Psychiatry, King's College London, uses the Experience Sampling Method to investigate stress sensitivity, aberrant salience, and threat anticipation as potential candidate mechanisms through which exposure to social adversity, particularly in childhood, may increase risk for psychosis. His work at Maastricht University is funded by a Veni grant from the Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) to investigate whether reasoning biases are a causal mechanism in the development of delusions in daily life, combining a real-life temporal association with an interventionist causal-model approach. Ulrich also currently is a Co-Investigator at the South London site of the HTA funded NEgative Symptoms of Schizophrenia (NESS) trial and involved in the analysis of experience sampling data of the European Network of National Networks studying Gene-Environment Interactions in Schizophrenia (EU-GEI).

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Martine van Nierop is a postdoctoral researcher at Maastricht University, The Netherlands. After studying clinical neuropsychology at the University of Leiden (The Netherlands), she started her PhD at Maastricht University, at the department of Psychiatry and Neuropsychology, which she received Cum Laude in January 2015. Her research line entails an investigation into the detrimental effects of childhood traumatic experiences in terms of psychopathology in adulthood. Her focus is on a specific mixed phenotype of psychopathology, including depression, anxiety, mania, and psychosis. Using large observational epidemiological samples and patient/sibling/control samples, including macro-assessment (questionnaires) and micro-assessment (experience sampling technology), she is unraveling possible underlying psychological models explaining the link between childhood trauma and psychopathology. During her PhD, she has worked at King's College London, adding to her network of collaborations with scientists throughout The Netherlands and Belgium. Since the start of her PhD in November 2010, she has published 13 papers in high ranking journals such as Schizophrenia Bulletin and Psychological Medicine, and has been invited to present her work in several international conferences in the United States and throughout Europe. She is now providing supervision of several PhD students in the organization and application of a new treatment study, and is the co-promotor in one PhD project.

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PhD candidate at the Department of Psychiatry and Psychology, School for Mental Health and Neuroscience, Maastricht University, Thomas Vaessen acquired a bachelor's degree in Biological Psychology and a research master's degree in Clinical and Cognitive Neuroscience at Maastricht University. His interests lie in experimental psychopathology and neuroscience with a focus on biobehavioral mechanisms of psychopathological symptomatology. Thomas gained hands-on experience in this field working at the Department of Clinical Psychological Science, Maastricht University, the Oxford Centre for Functional Magnetic Resonance Imaging of the Brain, Oxford University, the International Research Training Group "Brain-behavior relationship of emotion and social cognition in schizophrenia and autism", Rheinisch-Westfälische Technische Hochschule Aachen University. Also, he has gathered experience as a psychological therapist working at the Regionale Instelling voor Ambulante Geestelijke Gezondheidszorg and at Mondriaan, in Maastricht. His current research focuses on the neurobiological and biobehavioral stress response in psychosis and the effectiveness of intervention strategies that focus on stress reduction.

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Executive summary

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Arbitrary Self-Assessment Scale of Stress: Analysis and Discussion of the limited Relevance

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Abstract

In the aim of assessing subjects' perceived stress, some professionals are seduced by easy arbitrary rating scales which are elaborated for a one-off need out of any scientific and rigorous approach, sometimes called "numerical stress scale". The present research provides an insight into what sort of results may be expected from this kind of assessment. Research articles in peer reviewed journals providing cases of assessment of short-term stress through an arbitrary scale were analyzed and compared with studies applying scientifically validated questionnaires for self-assessment of stress. This objectified the poor reliability of the former compared to the latter and led to identification of weaknesses and improvement suggestions. A calibrating item for arbitrary scales was proposed for future validation.

1. Introduction

Self-assessment is an approach widely applied by professionals in Human Science in order to investigate the perception of subjects involved in a given context. Among these professionals, researchers are used to undertaking such self-assessments on the basis of previous scientific studies providing questionnaires which were tested and validated with several hundreds of subjects according to a strict protocol. Furthermore, these professionals do not usually use questionnaire in language other than that of the original one if the translated questionnaire has not been validated in these new languages. This contributes to validate the influence of another language as well as the influence of another culture associated with the language.

However, some professionals (even among researchers) are seduced by easy arbitrary rating scales which are elaborated for a one-off need out of any scientific and rigorous approach, sometimes called "numerical stress scale". One of the advantages of this type of scale is the following quick analysis: just one number per subject and per condition whereas questionnaires imply several numbers to calculate a score per subject and per condition. For example, Orsila et al. (2008) used what they called a "traditional questionnaire" described in their paper as follows (p.278): "A single survey item was used to assess perceived mental stress, which was elicited on a visual analog scale (from 0—very little stress to 10—very high stress)".

What results may be expected from this kind of assessment? Which level of confidence may be given to this kind of assessment? What kind of bias may affect the results?

The present short paper aims at giving elements of answer to these questions in the case of the assessment of short term stress by analyzing results available in the literature obtained with application of an arbitrary scale and compared with those provided by a scientifically validated method.

2. Material and methods

The stress which we addressed in this analysis was "short term mental stress", not "long term mental stress" linked with periodic stress factors exposure (for example refer to the work of Maslova et al. (2002) who studied the effect of chronic stress on arterial blood pressure, or studies of Schubert et al. (2009) who compared both kinds of stress). Most of the time, short term mental stress (sometimes referred to as "acute stress") occurs whilst dealing with an intense cognitive demand during a short time where "intense" is here taken in a broad range of sense.

It was first necessary to gather data. A bibliographic research aimed at identifying research articles in peer reviewed journals providing cases of stress assessment exclusively through an arbitrary scale for self-assessment of the stress state. For each article, we gathered characteristics of use of this type of scale and analyzed the results and conclusions obtained by the authors.

Arbitrary scales being not scientifically validated, we then presented characteristics of validated questionnaires for self-assessment of stress in order to emphasize the poor quality and reliability of the

former compared to the latter. To illustrate the reliability of validated questionnaires, we summarized a few examples of application of these questionnaires and compared the quality of the results obtained to what studies applying arbitrary scales produced.

3. Results

3.1 Arbitrary scale for self-assessment of stress in the literature

Papers presenting data of self-stress assessment using arbitrary scale are not numerous in the literature, perhaps due to the poor quality of information provided by this method. We only found four articles in peer reviewed journals (however there was one associated to the proceedings of a conference) in which authors used this kind of scale to argue their results regarding stress assessment. In each study, self-assessment of stress through arbitrary scale was compared with one or several physiological techniques of stress assessment but not with another subjective technique; even Goette et al. (2015), who applied the STAI-T questionnaire (Spielberger, 1983, 1989; see below §3.2) to evaluate subjects' trait anxiety and to analyze possible correlations with subjects' state did not apply the STAI-S aiming at evaluation the subjects' anxiety state whereas this questionnaire is scientifically validated. The authors did not explain why they preferred using an arbitrary scale.

The characteristics of stress conditions investigated in the selected papers are summarized in table 1. For all conditions of table 1, subjects were healthy adults, male or female.

Table 1: Characteristics of selected studies

Source	Stress conditions	*N*
Langewitz et al. (1987)	work context vs home context	about 30
Orsila et al. (2008)	occupational work	about 30
Geeraerts et al. (2010)	difficult clinical situation management on anesthesia simulator	about 30
Goette et al. (2015)	interview and Mathematics	about 200

For all conditions, stress was self-assessed using an arbitrary scale of the type described in section "Introduction".

Table 2 provides for each of these studies information about stress assessment techniques that were used in parallel to this arbitrary scale.

For each of these selected studies, the authors' conclusions regarding stress assessment were as follows.

Table 2: Stress assessment methods used in selected studies

Source	Stress assessment method
Langewitz et al. (1987)	blood pressure heart rate respiratory frequency
Orsila et al. (2008)	heart rate heart rate variability
Geeraerts et al. (2010)	salivary amylase
Goette et al. (2015)	salivary cortisol heart rate

Langewitz et al. (1987) compared two conditions of stress exposure for the whole sample: home and work. They concluded that, for the overall, all quantities assessing stress (objective as well as subjective) significantly showed a higher level of stress at work and that ANOVA revealed a significant effect of perceived stress on HR.

Orsila et al. (2008) was the only team presenting calculated correlation between the perceived stress through arbitrary scale and other physiological quantities used as objective assessment of stress (table 3 of their paper). They presented results for quantities generally used to evaluate stress:

- For *HR*, r=-0.41 (p=0.08) with 83% of data for which $p \geq 0.1$.
- For *LF/HF* of heart rate variability, r=-0.3 (p=0.2) with 83% of data for which $p \geq 0.1$.

and they presented results for untypical quantities used to evaluate stress:

- For the Baseline width of the *RR* interval histogram, r=0.73 (p=0.01) with 33% of data for which $p \geq 0.1$.
- For the root mean square of differences of successive *RR* intervals, r=-0.60 (p=0.04).

The authors concluded that "no single parameter seems to correlate with perceived stress" (p.282).

Geeraerts et al. (2010) compared the stress state of subjects just before and just after a given stressful situation for the whole sample: they concluded that they had a very good discrimination with a significant higher level of stress perceived after experiencing the situation than before. They did not mention any correlation between subjective and objectives quantities. However, for 11% of their

data, the perceived stress after experiencing the stressful situation was surprisingly lower than before.

Goette et al. (2015) separated participants into two groups (about 100 subjects each); one group experienced several stressful situations while the other, the control group, did not. They found that "the stress group exhibited higher subjective stress ratings as well as higher cortisol and heart rate level than the control group throughout the session. For subjective stress ratings, there was no significant difference between control and stress groups at the beginning nor at the end of the session. For subsequent measurements, there was a difference between the two groups" (p.118). Regarding physiological measurements, "stress participants had higher salivary cortisol levels than control participants in all measurements" except at the beginning: "there was no difference in salivary cortisol levels between groups"; this was complemented with the fact that "the heart rate differed between the control and stress groups from the minute after the start of the measurement" (p. 118-119).

The arbitrary scale helped the authors to discriminate the stress state of two samples (N>100 each) but they could not obtain discrimination in all the stress conditions studied using this scale: cortisol and HR were more discriminating. The authors did not present any analysis of correlation between subjective and physiological assessment of stress.

3.2 Characteristics of validated questionnaires for self-assessment of stress

There are few scientifically validated questionnaires available for self-assessment of stress. We provide hereinafter a list of such questionnaires with the scientific articles that make reference for each and we summarize the results obtained after the validation process.

ALES, Appraisal of Life Events Scale was elaborated by Ferguson et al. (1999).
The number of items for the questionnaire is 16, selected with reference to the four primary evaluation forms described by Folkman and Lazarus (1985).
The number of participants involved in the validation process is N=260 for exploratory analysis and N=344 for confirmative analysis, giving the total amount N=604.
It has good discriminative sensitivity and good theoretical validity. The internal validity of each factor is satisfactory (α = 0.94 to 0.99), as well as the reproduction through one month test-retest (r = 0.77 to 0.90, p < 0.01) as well as three-month test-retest (r = 0.49 to 0.59, p < 0.01). Regarding external validity, ALES factors are correlated significantly and relevantly with various criteria jointly evaluated (Ferguson et al., 1999).

STAI, State-Trait Anxiety Inventory was elaborated by Spielberger (Spielberger, 1983, 1989; Spielberger & Reheiser, 1994).
The number of items for the questionnaire is 40.
The number of participants involved in the validation process is N>5000.
The STAI intends to assess subjects' conscious awareness at two extremes of anxiety affect, labeled state anxiety (A-State), and trait anxiety (A-Trait), respectively. The original Form X of the STAI was revised resulting in Form Y, a more popular version with improved psychometric properties.
Internal consistency coefficients are satisfactory, ranging from 0.86 to 0.95; two-month test-retest reliability coefficients have ranged from 0.65 to 0.75 (Spielberger et al., 1983).

PDI, Peritraumatic Distress Inventory (Brunet et al., 2001) was elaborated in order to obtain a quantitative measure of the level of distress experienced during and immediately after a traumatic event.
The number of items for the questionnaire is 13.
The number of participants involved in the validation process is N=1003.
It includes the subject's feelings regarding physiological parameters (sweating, shaking, pounding heart). The problem for this questionnaire is that it is linked with the diagnosis of posttraumatic stress disorder (PTSD) which requires that subjects had high levels of distress during or after the traumatic event. This may be a drawback when subjects are submitted to a low level of stress: the questionnaire may not discriminate subjects' stress state (Fauquet-Alekhine et al., 2014).

JSS, Job Stress Survey elaborated by Spielberger (Spielberger, 1983, 1989; Spielberger & Reheiser, 1994) is devoted to perceived stress in professional context.
The number of items for the questionnaire is 60 for the original version and 40 for the shortened version keeping the more stable items (Spielberger & Reheiser, 1994).
The number of participants involved in the validation process is N=1781.
JSS permits to obtain three scores (intensity, frequency, overall) within three domains: job pressure, lack of support, the combination of which referring to occupational stress.
The internal consistency was good while repeatedly scored around 0.80 for the alpha coefficient, and test-retest coefficient was reported at 0.48 to 0.75.
Regarding stress at work, we may also notice the JCQ, Job Content Questionnaire (Karasek et al.,

1998) made of 21 items distributed in 5 domains and tested with more than N=15000 subjects.

For information regarding long term stress, we may notice the followings.

PSS, Perceived Stress Scale was elaborated by Cohen et al. (1983). The number of items for the questionnaire is 14.
The number of participants involved in the validation process is N>2300 (40% male) selected as representative of the North-American population (gender, age, income, ethnic, profession).
It has good discriminative sensitivity, a good theoretical validity, with positive correlations with other objective or perceived stress scales. Internal validity is satisfactory (Cohen & Williamson, 1998) and external validity shows that PSS correlates significantly and positively with various indicators of disease, among which the Psychosomatic Index of Derogatis et al. (1976). The questions in this scale ask subjects about their feelings and thoughts during the last month and thus are rather adapted for long term mental stress assessment.

EMS, Experience Sampling Method (Myin-Germeys et al., 2009; Vaessen et al, 2015) allows for in-the-moment assessment of subjective appraisal of a situation and the stress response reflected in current subjective distress or increases in negative affect and symptomatology.

WWBQ, Work and Well-Being Questionnaire (Kilminster et al., 2007; Bridger et al., 2011) was elaborated to measure occupational stressors in the navy.

4. Discussion

It is remarkable that, among all the selected arbitrary scale-based studies, the only one mentioning correlation calculation between subjective and objective quantities provided a very low level of correlation for almost all quantities and especially for all usual quantities used to evaluate stress (*HR*, *LF/HF*). We may assume here that other studies did not dare mentioning any correlation calculation because of their poor quality as reported in §3.1.

No study regarding consistency of arbitrary scale-based questionnaire has been found in the literature probably because of their poor reliability. This poor reliability is obviously mainly due to the high possible disparity which may appear between subjects submitted to the same conditions of stress. This assertion is well illustrated by Geeraerts et al.' data the analysis of which is summarized in §3.1; data are given for each subject in their paper: the variance of perceived stress data related to "before" stress situation is about 30% of the full scale and 50% when related to "after"; this is 63% and 70% of the mean values respectively.

On the contrary, using scientifically validated questionnaire gives reliable data that leads to consistent results. Figure 1 gathers data from two different studies providing data describing subjects in different stressful conditions. This data are from Stedmon et al. (2015) and Berger et al. (2016). Stedmon et al. provided 4 points from the analysis of N=38 subjects. Berger et al. provided 4 points from the analysis of N=80 subjects. Stedmon et al. analyzed subjects trying to conceal knowledge from interrogators leading them to experience raised levels of stress. Berger et al. recruited subjects to undergo either a social stress situation or a non-stressful control situation. Both studies provided data comparing scores obtained with STAI-S vs HR for groups of subjects in different stressful conditions. When plotted together (Fig. 1), the correlation coefficient is $r(N=8) = 0.95$, $p < 0.0001$. Compared with data of Orsila et al. (2008) summarized in §3.1, Here a clearly higher quality was found for correlation between self-assessment of stress and a physiological quantity illustrating a stress state. This level of quality is not so surprising when taking into account all that was done to validate the STAI questionnaire and the fact that stress is assessed through 40 items instead of a single one.

According to our analysis, the main problem of arbitrary scales for self-assessment of stress is associated with its lack of calibration: even if two subjects feel the same level of stress in a given situation, they may score it at different levels over the scale. For a sample of subjects, this leads to a large variance of the scores which contributes to the poor quality of results obtained with this type of questionnaire. Spielberger (Spielberger, 1983, 1989; Spielberger & Reheiser, 1994) coped with this problem by providing a calibrating item: for the JSS (presented in §3.2), the intensity index is scored over a 1-9 scale, the medium value 5 being calibrated with the first item referring to a subject submitted to unpleasant tasks. This calibrating item leads subjects to score the following items higher than 5 if they are considered more stressful than the calibrating item by the subjects; it is scored less than 5 if the opposite should apply.

For the arbitrary scale of self-assessment, a calibrating level must at least comply with the following properties:

- It must relate to a medium level of stress to make a higher or a lower assessment possible.
- It must concern as much healthy adult subjects as possible, regardless gender, age, profession, social status.

- It must be comparable to other stress factors in as many contexts as possible.

It is clear that this is not easy to fulfill all the criteria at the same time.

The calibrating item referring to the medium level of the scale could be: "you have a letter to send in emergency by post office but you do not have any stamp for it; you are in center town and you know you just have time to go in the last shop which will sell to you the stamp so that your letter might be put in the letter box today to have the stamped date of the day".

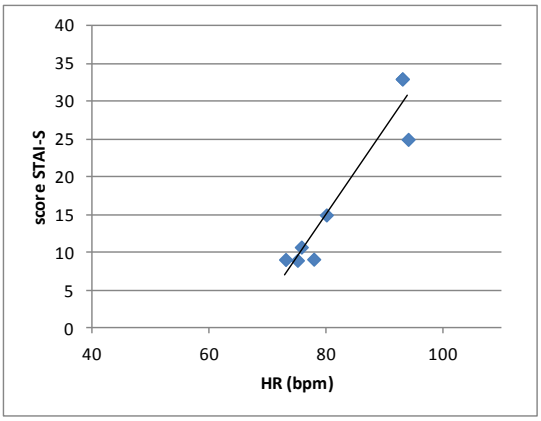

Fig. 1. STAI-S vs HR for groups of subjects in different stressful condition (from Stedmon et al., 2015 and Berger et al., 2016).

When analyzed in the light of aforementioned criteria, this suggested item to calibrate the scale leads to few comments regarding the aforementioned properties that contribute to its limitation:

- Relate to a medium level of stress: anyway, even though many people are concerned by the suggested item, there will be a bias due to personality (as for JSS) and due to culture. This last point might present a reduced limitation as usually tests are undertaken for a sample of subjects concerned by a single culture, making data comparable from one subject to another.
- Concern as much healthy adult subjects as possible: again, even though many people are concerned by the suggested calibrating item, there will be a bias due to personality.
- Be comparable to other stress factors in as many contexts as possible: regarding this point, only a study testing an arbitrary scale applying the suggested calibrating item may objectify a possible bias.

5. Conclusion

Analysis of research articles in peer reviewed journals providing cases of stress assessment exclusively through an arbitrary scale for self-assessment of the state of stress showed the poor reliability of this type of scale. Correlations with physiological parameters were rarely provided by authors, and when they were, the coefficients and significance were low.

A short (and not exhaustive) review of validated questionnaires for self-assessment of stress was undertaken, showing how carefully these questionnaires were elaborated and studied, involving several hundreds or thousands of subjects. An example of correlation between one questionnaire of this type, the State-Trait Anxiety Inventory (STAI), and physiological parameters was given. Two independent studies were used to provide data and calculation showed high correlation, thus illustrating the benefits of scientifically validated questionnaires.

The main problem of arbitrary scales for self-assessment of stress is associated with its lack of calibration: even if two subjects feel the same level of stress in a given situation, they may score it at different levels over the scale. For a sample of subjects, this leads to large variance of the score which contributes to the poor quality of this type of questionnaire. A calibrating item referring to the medium level of the scale is therefore suggested: "you have a letter to send in emergency by post office but you do not have any stamp for it; you are in center town and you know you just have time to go in the last shop which will sell to you the stamp so that your letter might be put in the letter box today to have the stamped date of the day". However validation remains to be carried out. This may be a future research project.

Symbols & Units

Symbol	*Quantity*	*Units (SI)*
N	Sample size	unit
α	Cronbach coefficient	none
p	Probability	none
r	Correlation coefficient	none
HR	Heart Rate	bpm
LF/ HF	Low and high frequency ratio of heart rate variability	none
RR	rhythm-to-rhythm (RR) interval	ms

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Stress Assessment using Experience Sampling: Convergent Validity and Clinical Relevance

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Abstract

Subjective appraisal and experience are key aspects of stress, but most questionnaires fail to assess these measures within the transitory time-window of the acute stress response. The experience sampling method (ESM) overcomes this issue and allows for in-the-moment assessment of subjective appraisal of a situation and the stress response reflected in current subjective distress or increases in negative affect and symptomatology. The current manuscript discusses these measures and attempts to assess their validity and clinical relevance based on previous literature. Several established physiological markers of the stress response were shown to relate to ESM measures of subjective distress and affective and psychotic reactivity to daily life stressors. Across the psychopathology spectrum, ESM measures indicated increased stress sensitivity and a pathology-specific physiology. Childhood trauma and stressful life events are likewise associated with a sensitized affective response to daily stressors as measured with ESM, and in these groups psychotic stress reactivity specifically increased in psychotic individuals. Thus, although there remains room for improvement, the evidence suggests that ESM measures of subjective distress and affective and psychotic reactivity are indeed valid and meaningful.

Keywords: stress; experience sampling method; questionnaire; validity; cortisol; childhood trauma.

1. Introduction

During the last century the concept of "stress" has taken a central position in both preclinical and clinical research. Its implications range from an organism's most basic survival tactics to physical and mental well-being (Juster et al., 2011). In humans, aside from major stressors such as abuse, unemployment, divorce, or death of a loved one, minor stressors that occur naturally in the flow of daily life are believed to pose a risk to those individuals who are predisposed to somatic or psychological illness (Ingram & Luxton, 2005). In order to identify, understand, and possibly influence this complex concept and its consequences, accurate assessment of the stress response is crucial. So, what do we mean when we say stress or stress response?

1.1 The concept of stress

The definition of stress remains topic of discussion. Public speaking, important deadlines, and rumination are just a few examples of situations in which people may express that they are "stressed". On the other hand, we refer to stress as that what an animal experiences when faced with a hungry predator, or *is* a hungry predator. Indeed, stress is a complex concept that encompasses several components. One such component is a stressor, which can be conceptualized as anything that causes disbalance to an organism's homeostatic equilibrium (Sapolsky, 1994). This imbalance triggers an innate, automatic reaction in the organism's physiology aimed at reinstatement of homeostasis through allostasis, known as the acute stress response. This immediate reply to threat is highly adaptive and functions ultimately to secure survival. However, when the stress response is triggered repeatedly or persists over a longer period of time (i.e. becomes chronic) this protective mechanism may have devastating consequences for the organism.

In addition to the beneficial effects of increased chances of survival, the stress response may have detrimental effects on an organism's biology- a phenomenon coined allostatic load. Especially when exposure to a stressor is prolonged or recurrent (i.e. chronic), the excessive release of stress hormones may impair cardiovascular, metabolic, and immune functioning, and promote neuroinflammation (McEwen, 2006). In humans, chronic stress is implicated in the epidemiology of a broad range of mental disorders (de Kloet, Joels, &

Holsboer, 2005; McEwen, 1998, 2004; Varese et al., 2012; Walker & Diforio, 1997), urging for a better understanding of its dynamics. Thus, whereas a single, short-lived stress response may not pose a direct threat to a person's well-being, a prolonged or recurrent stress response to either a physical or cognitive stressor can have detrimental effects on both somatic and psychological health.

1.2 The physiological stress response

From an evolutionary viewpoint, the stress response is seen as an adaptive reaction to (life-)threatening situations, promoting immediate behavioral action. In humans and other vertebrates, two major biological systems mark the human stress response. First, activation of the sympathoadrenal system (SAS) results in a fast release (within seconds of stress-onset) of peripheral and central catecholamines, activating the sympathetic nervous system and bringing the organism in a state of high-energy that is characteristic for the behavioral stress response. Second, the hypothalamic-pituitary-adrenal (HPA) axis sets in motion a slower cascade of neuroendocrine activity (over a course of 30 minutes after stress-onset) resulting in corticotrophin releasing factor (CRF), adrenocorticotrophic hormone (ACTH) and cortisol release. The boost of sympathetic activation and the fast effects of the neuroendocrine system that a stressor triggers are aimed at successful coping, typically in a *fight-or-flight* fashion, whereas the slow effects of neuroendocrines reverse these effects to restore balance (Hermans, Henckens, Joels, & Fernandez, 2014). This response offers opportunities to escape the stressor and secure survival.

1.3 Subjective appraisal of stress

In today's western society, rather than situations where we need to fight or run for our lives, stress usually arises from psychological stressors such as daily hassles, interpersonal quarrels, or a high workload. Whereas they do not directly pose an immediate threat to one's somatic well-being, and effective coping strategies typically involve no fighting or running, these situations may cause considerable problems when a person appraises them as a stressor. Under identical circumstances, a daily hassle such as a delayed train may be a stressor to one person but not to another, depending on their respective evaluation of the situation. Subjective appraisal is a process that influences whether or not something becomes a source of stress (i.e. a stressor), and, at least in the case of negative (i.e. stressful) appraisal, consequently induces a stress response reflected by subjective feelings of distress and increased negative affect. Furthermore, subjective appraisal predicts the acute physiological stress response (Gaab, Rohleder, Nater, & Ehlert, 2005; Harvey, Nathens, Bandiera, & Leblanc, 2010). Thus, a physiological stress response may be set in motion solely by the perception of a threat, even when an "actual" threat to homeostasis is lacking.

The implications of this becomes clear when we consider that prolonged or recurrent exposure to major life events, traumatic experiences, or daily life stressors may occur through memories, flashbacks and rumination, which in itself may again trigger a full-blown stress-response, depending on the subjective appraisal. Indeed, negative appraisal may contribute to the development of posttraumatic stress disorder (Dunmore, Clark, & Ehlers, 1999), and constitutes one of its core features. The next paragraph discusses the complex interplay between the potential stressor, cognitive appraisal, subjective distress, affectivity, and physiology.

1.4 The relation between physiological and subjective responses

The human physiological stress response thus seems to depend at least in part on the subjective cognitive appraisal of a situation. This, however, does not imply a one-to-one relationship, or directionality, between subjectively experienced distress and the physiological stress response. For instance, some situations, such as suddenly almost getting hit by a car when you cross the street, immediately trigger a sympathetic response for which no elaborate cognitive appraisal is required. Moreover, subsequent positive (i.e. non-stressful) appraisal of the stressor might reduce the initiated stress response quickly. So, how do feelings of distress and negative affect, induced by a perceived stressor, relate to a physiological stress response?

Multiple studies that experimentally induced stress in a lab have associated subjective reports of distress or negative affect with cortisol levels. Whereas physical stressors, such as nociceptive stimulation, are relatively easy to implement in experimental research, they form a particular category of stressors that have relatively low ecological validity. Psychological stressors on the other hand may represent more daily life stressors, but confront researchers with some challenges. Several experimental tasks have been proposed to mimic psychological stressors in attempts to investigate the acute stress response. In an extensive meta-analysis, Dickerson and Kemeny (2004) compared 208 studies that made use of a

psychological stress task on their effectiveness to elicit a cortisol response. They found a considerable amount of variation between stressors, with some tasks that did not significantly increase cortisol levels, and some that yielded very strong responses. The most robust cortisol increases were obtained with tasks that induced a sense of uncontrollability and posed a social evaluative threat. Of these tasks, the Trier Social Stress Task (Kirschbaum, Pirke, & Hellhammer, 1993), where participants are confronted with an unpredictable public speech scenario, cognitive pressure, and negative feedback, is generally the most effective in terms of cortisol-induction. Interestingly, increases in cortisol were not associated with measures of subjective distress and negative affect, which were increased in all types of tasks, suggesting that subjective feelings of stress are not always predictive of HPA-axis involvement. While acknowledging the complex interplay of subjective appraisal, mood, and physiology, this finding is unexpected when considering that several studies found negative affect to mediate the relation between daily stressors and HPA-axis reactivity (Buchanan, al'Absi, & Lovallo, 1999; Smyth et al., 1998; van Eck, Berkhof, Nicolson, & Sulon, 1996). Apart from the issues that have been discussed to confound the relation between subjective reports and cortisol, measurement of physiological measures comes with several methodological complications such as timing and practicality. Also, stress is not the only influence on cortisol levels, and omission of important covariates results in more unexplained variance. On the other hand, subjective reports are similarly subject to much variation, for instance due to memory bias or social desirability, hence decreasing the likelihood of finding an association. Questionnaires such as the Perceived Stress Questionnaire (Levenstein et al., 1993), have been developed to measure the subjective appraisal of stress. However, it remains questionable to what extend these questionnaires reliably and validly tap onto the stress response. Particularly, since stress refers to a transient state, timely and accurate assessment is key to capturing its immediate effects in the moment. Ambulatory strategies may overcome some of the biggest issues by assessing appraisal, subjective distress, and affect in the current moment, diminishing recall bias and allowing for brief, in-the-moment measurement.

1.5 Aim of this manuscript

As a person's assumed introspective capacities allow for assessment of the subjective experience associated with the acute stress response, the important issue arises whether verbal reports on subjective appraisal, distress, and affect form a meaningful source of information. As arguably the most suitable candidate to accurately capture this transient process, it would be valuable to see to what extent ambulatory stress assessment, such as experience sampling, constitutes a valid and meaningful method. As such, associations are expected with established physiological and psychological derivatives of the stress response to provide a case for its validity as an estimator of the subjective appraisal of daily life stressors. The current manuscript aims to assess the construct and convergent validity of experience sampling measures of acute stress through associations with established measures of the acute stress response and its relevant consequences. It first describes the subjective assessment of stress (§2.1), the associated subjective response (§2.2) and it discusses the validity of experience sampling stress assessment through comparative analysis with other techniques and with physiological assessments.

2. Subjective stress in daily life

As discussed earlier, stress and the stress response refer to a transient state, it originates in interaction with environmental contexts that change over time. In order to capture this moment-to-moment variation, we need a method that allows us to assess stress real-time in daily life. The Experience Sampling Method (ESM), (Csikszentmihalyi & Larson, 1987; Myin-Germeys et al., 2009), also known as Ecological Momentary Assessment (EMA) (Shiffman, Stone, & Hufford, 2008) or Ambulatory Assessment (AA) (Trull & Ebner-Priemer, 2013) is a structured diary technique, assessing subjective experiences in the context of daily life. Individuals fill out questionnaires throughout the day in their natural environments, where daily hassles and small disturbances from a natural source of stressful events and situations. ESM may thus provide an excellent method to study stress and the stress response.

The ESM consists of multiple measurements over the day at a number of consecutive days (typically 8 to 10 reports over 5 to 6 consecutive days) (Palmier-Claus et al., 2011). Participants receive a watch and a paper and pencil diary, a palm-top or an application on their smartphone. They receive an auditory signal at semi-random occasions throughout the day, referred to as "beeps". Following a beep, participants are required to fill out a questionnaire assessing their current mood, (sub)clinical symptoms, activities, social context and events. The ESM reports thus provide multiple

assessments per person, within the moment avoiding recall bias, and in direct relation to the context.

2.1 Subjective appraisals of stress

ESM is typically used to assess subjective experiences of stress, what we referred to earlier as appraisals of stress (Myin-Germeys & van Os, 2007; I. Myin-Germeys, J. Van Os, J. E. Schwartz, A. A. Stone, & P. Delespaul, 2001a). Different stress-appraisals have been used (see table 1 for an overview).

2.1.1 Event-related stress

Event-related stress is most closely related to the concept of daily hassles. Participants are asked to fill out the most important event that happened between the previous and the current beep (time frame ranging between 15 minutes and 3 hours). Participants are invited to always fill out a response (no matter how unimportant the event). This is to avoid biases in response style, such as people only filling out the questionnaire when extreme events have happened. People are then asked to report how pleasant – unpleasant this event was on a bipolar Likert scale (-3 'very unpleasant' to 3 'very pleasant') and how important this event was (-3 'not important at all' to 3 'very important'). Events that were rated as unpleasant and important are considered stressful events (although many studies have only used the pleasant-unpleasant variable).

Instead of directly asking about the stressfulness of events, this approach is deriving experienced stressfulness from a combination of unpleasantness and importance. The reason for using an implicit approach is that an ESM questionnaire is designed to assess current state as accurately as possible, thus avoiding questions that may be vulnerable to social desirableness or may be influenced by general ideas about the self. As stress, nowadays, is a widely used but poorly defined concept that may be vulnerable to triggering global self-reflections, an implicit approach was chosen. However, it still remains to be shown that the implicit approach indeed is preferential over an explicit approach.

2.1.2 Activity-related and social stress

Whereas event-related stress is reflecting on a period of time (between two beeps) and is closely related to the concept of daily hassles, ESM also provides the opportunity to investigate even smaller levels of disturbances and annoyances that happen in the flow of daily life. We refer to appraisals of current context that may be considered as stressful.

The first context relates to activities that one is involved in. Participants are asked to report the activity that they are currently doing and subsequently provide an appraisal of these activities. The items 'I am skilled to do this activity' (reverse scored), 'I would rather do something else' and 'This activity requires effort' (all scored on a Likert scale from 1 'not at all' to 7 ' very') constitute activity-related stress.

The second context is the social context. Participants are asked about their current social context ("Whom are you with at this moment?" and subsequently, they appraise this context. The items 'I like this company' (reverse scored) and, 'I would rather be alone' constitute social stress.

2.2 The subjective stress-response

ESM can also be used to examine the stress response. This has been done in two different ways. Either one directly assesses subjective experiences of feeling distressed. Alternatively, a number of studies have investigated the impact of subjective stress-appraisals on current mood or (sub) clinical symptoms (i.e. psychotic symptoms). The latter is often referred to as reactivity to stress.

2.2.1 Subjective experiences of distress

Subjective distress includes items such as 'I'm in control' (reversed), 'I feel pressured', 'I feel comfortable among these people', 'I feel relaxed' (reversed), 'I feel judged', 'I do not live up to expectations'. These items thus refer to experiences of control and pressure. Although not often used in ESM stress studies, the composite measure including these items has been externally validated using an established experimental psychosocial stress task (the Montreal Imaging Stress task – inducing stress by combining performing aritmetics under time pressure combined with psychosocial stress (Pruessner, Champagne, Meaney, & Dagher, 2004) that has been shown to trigger an endocrine stress response in multiple samples (Dedovic et al., 2005; Pruessner et al., 2004; Pruessner, Hellhammer, & Kirschbaum, 1999). During this task, substantial task-induced increases in ESM subjective distress ratings were observed in samples of healthy subjects, psychotic patients, and first-degree relatives of psychotic patients (Hernaus, Collip, Kasanova, et al., 2015; J. Lataster et al., 2011; J. Lataster et al., 2014), suggesting that this method of assessment indeed indicates a response to a stressful situation.

2.2.2 Reactivity to stress

ESM has also been used to examine how people react to subjective appraisals of stress, what we then would call the stress-response. One could examine how subjective experiences of stress are related to changes in mood. Mood mostly is defined as two separate variables, either positive affect (a composite score of items such as "I feel satisfied", "I feel relaxed", I feel cheerful") or negative affect (a composite score of items such as "I feel down", "I feel anxious", "I feel lonely", "I feel guilty", "I feel insecure"). This emotional response has been investigated in relation to event-related stress, activity-related stress, and social stress, both in healthy populations as well as in individuals suffering from psychopathology. It is important to note that emotional stress-reactivity is not assessed with a reflective question. Participants do not report how they feel in a certain situation (e.g. In this social context, I feel down or cheerful). Rather, participants report on their current mood, symptoms, context and appraisals of this context. The association between subjective appraisal and emotional reaction has later been made statistically by the investigator. This again precludes social desirability and response biases.

Within psychiatric populations, a stress response can also consist of increases in psychopathology. This has especially been investigated in relation to psychotic experiences (Lataster, Collip, Lardinois, van Os, & Myin-Germeys, 2010; Myin-Germeys, Delespaul, & van Os, 2005b; Myin-Germeys, Marcelis, Krabbendam, Delespaul, & van Os, 2005b; Myin-Germeys et al., 2003; Myin-Germeys, van Os, Schwartz, Stone, & Delespaul, 2001b; Palmier-Claus, Dunn, & Lewis, 2012). Psychosis has been assessed with items such as 'I feel suspicious', 'I feel unreal', 'My thoughts are being influenced by others', 'I can't get rid of my thoughts', 'I see things that aren't really there', 'I hear voices', and 'I'm afraid I'll lose control'. These psychotic experiences have also been associated with subjective experiences of stress.

In sum, various ESM measures of subjective stress appraisal and stress-response have been put forward to capture important aspects of the subjective stress experience. However, the question remains whether subjective stress measures and the stress-response as measured with ESM are a valuable and valid measure of stress. In the next paragraph, we will discuss the validity of the subjective stress response as assessed with ESM. In light of construct validity using the "known groups" method (Prince, Stewart, Ford, & Hotopf, 2003), we will compare ESM subjective stress-reactivity in samples with different psychopathologies known to be associated with vulnerability to stress. Furthermore, we will investigate convergent validity, by associating these

Table 1: ESM measures of stress appraisals and stress response

Subjective Stress Appraisals	**Stress response**
Event-related stress (-3=very unpleasant; 3=very pleasant) *'Think about the most important event since the last beep. This event was…'*	Subjective stress (1=not at all; 7=very) *'I'm in control'* (reversed), *'I feel pressured', 'I feel comfortable among these people', 'I feel relaxed'* (reversed), *'I feel judged', 'I do not live up to expectations'*
Activity-related stress (1=not at all; 7=very) *'I am not skilled to do this activity', 'I would rather do something else', 'This activity requires effort'*	Emotional stress reactivity (1=not at all; 7=very) Negative affect: *('I feel down / guilty / insecure / lonely / anxious'*) Positive affect: (*'I feel cheerful / relaxed / satisfied'*)
Social stress (1=not at all; 7=very) *'I don't like this company', 'I would rather be alone'*	Psychotic stress reactivity (1=not at all; 7=very) *'I feel suspicious', 'I feel unreal', 'My thoughts are being influenced by others', 'I can't get rid of my thoughts', 'I see things that aren't really there', 'I hear voices'*, and *'I'm afraid I'll lose control'*.

subjective stress measures with the physiological stress response. Finally, we will investigate whether subjective ESM stress measures are related to assessments of childhood trauma or Life Events.

3. Validity of ESM subjective stress measures

3.1 ESM stress reactivity in psychopathology

If the subjective stress response as measured with ESM truly is a reflection of a stress response, we would expect populations with a theoretical increased vulnerability to stress to report more ESM emotional reactivity to stress. This technique is called the "known groups" method (Hattie & Cooksey, 1984) and has been used to assess construct validity. Following the vulnerability-stress model, psychiatric populations in general are considered to be more stress-reactive compared to healthy controls. This may be particularly true for patients with depression (who overall report higher exposure rates to life events) and patients with psychotic disorder. Several studies have investigated subjective emotional reactivity to stress in different patient populations.

Patients with major depressive disorder (MDD) showed increases in negative affect associated with activity-related and social stress (Myin-Germeys et al., 2003). Similarly, higher negative affect reactivity to event and activity stressors was found in patients with non-remitted MDD compared to remitted patients in whom the stress-reactivity was normalized (M. van Winkel et al., 2015). This supports the notion that the subjective stress response as measured with ESM is capturing meaningful variation at the level of the stress-vulnerability.

Similarly, many studies have been conducted in patients with a psychotic disorder. It was shown that patients diagnosed with a psychotic disorder (Myin-Germeys, Delespaul, & van Os, 2005a; Myin-Germeys et al., 2003; Myin-Germeys et al., 2001a), their first-degree relatives (Myin-Germeys, Marcelis, Krabbendam, Delespaul, & van Os, 2005a; Myin-Germeys et al., 2001a) as well as people at psychometric risk for psychosis (T. Lataster et al., 2009) and people at ultra high risk for psychosis (Palmier-Claus et al., 2012), showed increased emotional and psychotic reactions to stress as measured with ESM compared to healthy controls. Furthermore, increased stress-reactivity was particularly found in patients with positive symptoms of psychosis (T. Lataster et al., 2010; T. Lataster, Valmaggia, Lardinois, van Os, & Myin-Germeys, 2013), and was more pronounced in women (Myin-Germeys, Krabbendam, Delespaul, & van Os, 2004). In these studies, it was particularly relevant to use subjective stressors to examine the stress response, as patients with psychosis are thought to experience to environment as more stressful compared to controls (e.g. buying a bread in a bakery for a patient may be appraised as stressful as giving a lecture for a full auditorium would be for a healthy individual). However, using the subjective stress appraisal provides us with the opportunity to compare the stress response across populations.

These data thus seem to underscore that the subjective stress response as measured with ESM is distinguishing psychiatric from healthy populations as well as patients with more versus less symptoms, in the expected direction. These data thus support construct validity and provide a first suggestion that the ESM subjective stress response is capturing meaningful variation, which is possibly related to stress.

3.2 Hypothalamic-adrenal-pituitary axis

In order to provide more direct arguments, we now move to associations with biological markers of the stress response. Increased HPA-axis functioning poses itself as a prime target of reference when validating a stress questionnaire. ESM measures of emotional reactivity to stress should, therefore, be associated with derivatives of increased HPA-axis activation.

Several structural changes are associated with prolonged HPA-axis hyperactivity. For example, the size of the pituitary gland is increased in psychosis due to a sensitized hormonal stress response (Pariante, 2008). Likewise, a smaller hippocampal volume is associated with excessive hormonal release due to a hyperactive HPA-axis; experimentally increased cortisol release decreases hippocampal volume already within three days (E. S. Brown et al., 2015). Indeed, ESM stress measures seem to relate to these markers of a sensitised stress response. Variations in daily life emotional reactivity to stressful events (i.e. event-related stress) were directly associated with both reduced hippocampal volume (Collip et al., 2013) and increased pituitary volume (Habets et al., 2012). This suggests that, at least on a structural level, subjective emotional responsivity to stressful events in daily life as measured with ESM reflects altered physiological and neuroendocrine functioning due to excessive exposure to stress. However, to investigate whether subjective stress also varies with the acute neuroendocrine stress

response we need more functional measures, such as hormones.

Salivary cortisol is a valid and reliable measure of free (unbound) cortisol in the blood (Hellhammer, Wust, & Kudielka, 2009) and can be easily implemented in an ESM approach. Following the onset of a psychological stressor, increases in salivary cortisol can be measured within 5-10 minutes after stressor onset, but peak-levels are reached after 15-30 minutes (Kirschbaum & Hellhammer, 1994; Schlotz et al., 2008). ESM cortisol sampling in daily-life is done with cotton salivettes (Salivette, Sarstedt, Etten-Leur, The Netherlands). Following a beep, after filling-out a digital questionnaire, participants collect a saliva sample using a salivette, record the exact time of sampling, and store the sample in their home freezer until transport to the lab. This method yields 81% compliance rates as measured with an electronic monitoring device (Jacobs et al., 2005).

Several studies related daily-life stress as measured with ESM questions to fluctuations in free cortisol. For instance, during acute experimentally induced stress using the Montreal Imaging Stress Task, higher task-induced subjective distress ratings (using ESM questions) are indicative of increased levels of free cortisol in healthy volunteers (J. Lataster et al., 2011), indeed linking ESM subjective distress rates to the endocrine stress response. However, a study by Hernaus and colleagues (2015) failed to find this association in samples of healthy volunteers and psychotic patients under similar circumstances. Interestingly, the study by Hernaus et al did not find an increase in blood plasma cortisol levels during experimental stress, suggesting that no robust endocrine stress response occurred in these samples, which could possibly explain the lack of an association. Replication studies will have to indicate whether ESM subjective distress rates are indeed related to cortisol levels.

As ESM stress measures aim to assess subjective appraisal of stress under more ecologically valid circumstances, we have to move beyond laboratory settings and into daily life. Studies have looked at daily life measures of subjective stress appraisal and compared them with salivary cortisol levels to see if the two measures are related. Although Collip et al. (2011) indeed found that ESM event-related stress is predictive of increased free cortisol levels in a sample of first-degree relatives of psychotic patients (a group that shows increased sensitivity to daily life stressors (T. Lataster et al., 2010; Myin-Germeys, Marcelis, et al., 2005b)), this association was not observed in a large sample of healthy women (Jacobs et al., 2007), suggesting that ESM subjective stress is only related to a cortisol stress response in stress-sensitive individuals. However, considering that event-related stress is operationalized as a rating of the most important event since the last beep on a scale ranging from very unpleasant to very pleasant, the time period between the reported event and cortisol sampling may vary up to 180 minutes, possibly exceeding the optimal cortisol sampling time-frame. As subjective experiences can outlast the physiological stress response, the effect of event-related stress on levels of free cortisol might be less pronounced because the timing of the ESM event-stress assessment. The association found in first-degree relatives of psychotic patients may reflect an increased reaction of cortisol to daily hassles in this sample, large enough to measure under these circumstances.

Other ESM subjective stress measures assess stressful situations at the time of beep; activity stress and social stress allow for in-the-moment response assessment (Myin-Germeys et al., 2001b). With these real-time stress measures, reactivity is related to the stress measures within the same beep. If ESM assessment of subjective stress reactivity is reflective of a full-blown stress response, associations should be observed between these real-time measures and the neuroendocrine response. Indeed, the study by Jacobs et al. (2007) showed that both activity-related stress and social stress are associated with salivary cortisol levels at the time of assessment, and that in both cases the effect is mediated by negative affect, affirming the hypothesis that ESM stress and salivary cortisol may be sides of the same coin. A subjectively reported daily life stressful activity or social situation and the subsequent increase in negative mood thus seem to co-occur with activation of the HPA-axis, indicative of a neuroendocrine stress response.

3.3 Sympathoadrenal system (SAS)

In addition to HPA-axis measures, the immediate effects of stress on sympathetic nervous system activation allow for a directly measurable association between ESM stress (reactivity) and central and peripheral measures of stress-induced catecholaminergic increase. For instance, following an experimental acute psychosocial stress task, increases in subjective stress are related to task-induced dopaminergic (DAergic) activity in the medial prefrontal cortex (vmPFC), as measured with positron emission tomography (J. Lataster et al., 2014).

That the DAergic system particularly has been ascribed a role in psychosis (Howes et al., 2012) specifically forecasts a link with ESM psychotic stress reactivity. Indeed, in first-degree relatives of psychotic patients (individuals at increased genetic risk for psychosis), daily life psychotic reactivity to event-related stress is predictive of increased plasma levels of homovanillic acid, a major DA metabolite, during an acute metabolic stress task (Myin-Germeys, Marcelis, et al., 2005b). Regarding the central nervous system, psychosis is marked by increased DAergic activity in regions of the midbrain and striatum (Fusar-Poli & Meyer-Lindenberg, 2013). In addition, it has been suggested that prefrontal DAergic activity is reduced in psychosis (Davis, Kahn, Ko, & Davidson, 1991). In line with this suggestion, increased psychotic reactivity to task-induced stress signals less task-induced DAergic activity in the prefrontal cortex in first-degree relatives of psychotic patients (J. Lataster et al., 2014). One study combined a neuro-imaging PET stress approach with ESM in daily life. This study found increased psychotic reactivity to activity-related stress to be related to decreased mPFC DAergic activity during an acute psychosocial stress task (Hernaus, Collip, Lataster, et al., 2015), possibly linking ESM-based measures of psychotic stress reactivity with a DAergic stress response. However, results on prefrontal DAergic functioning in psychosis are limited and inconsistent (see Kambeitz, Abi-Dargham, Kapur, & Howes, 2014 for a review). For example, no increased DA-ergic response was observed in a PET stress study using a sample of non-medicated psychotic patients (Hernaus, Collip, Kasanova, et al., 2015). This renders statements on the relation with ESM measures of psychotic reactivity to stress speculative.

Summarizing, ESM assessment of subjective stress and stress reactivity have been directly associated with the peripheral and central catecholaminergic stress response. The evidence suggests that ESM-based assessment of subjective stress and stress reactivity reflects the physiological response to both task-induced and daily-life stress, affirming its convergent validity.

3.4 Childhood trauma and life events

A final argument in the validation of the ESM subjective stress approach is to investigate whether subjective stress reactivity as measured with ESM is related to exposure to major stressors such as childhood trauma or adversity and stressful life events. Childhood trauma refers to a range of early negative and potentially harmful experiences (Morgan & Fisher, 2007). Studies have focused on a wide variety of different types of childhood trauma, ranging from accidents (Arseneault et al., 2011), poverty (Luby et al., 2013), parental death (Appel et al., 2013), war (Okello, De Schryver, Musisi, Broekaert, & Derluyn, 2014), to neglect and abuse (van Nierop et al., 2014), and peer victimization (T. Lataster et al., 2006). Adult life events refer to "situations or occurrences that bring about a positive or negative change in personal circumstances and/or involve an element of threat" (Beards et al., 2013, p. 740). While the concept of life events overlaps to a degree with that of childhood trauma, the former will be used here to refer exclusively to events in adulthood.

In this paragraph, we are examining whether exposure to major stressors can be picked up and detected at the micro-level of daily life. It has been hypothesized that prolonged or repeated exposure to environmental stressors may increase sensitivity to minor day-to-day stresses through a process of sensitization (Collip, Myin-Germeys, & Van Os, 2008), the latter being an important factor in increasing risk of mental disorder. In the following, we will synthesize and discuss the available evidence of the impact of large environmental exposures on the subjective stress response as measured with ESM.

3.4.1 Childhood trauma

Childhood trauma is usually assessed with structured interviews or (self-report) questionnaires. Some examples of self-report questionnaires are the frequently used Childhood Trauma Questionnaire (CTQ) (Bernstein et al., 2003), or the Childhood Experiences of Care and Abuse Questionnaire (CECA.Q) (Bifulco, Bernazzani, Moran, & Jacobs, 2005). In the CTQ, items are divided over five subscales of childhood trauma (physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect), and each item is recorded on a frequency scale. The CECA.Q includes similar items, but for each item the severity of the experience is recorded, using pre-selected examples (e.g. levels of physical abuse, ranging from spanking to more sever forms) indicating the level of severity.

Although many childhood trauma studies have been published, which all have a different focus (e.g. importance of type of trauma, or focus on different types of psychopathology), the general consensus of most studies is that experiencing (severe) childhood trauma can lead individuals to have an increased stress sensitivity throughout life (Aas et al., 2014; Heim, Mletzko, Purselle, Musselman, & Nemeroff,

2008; Kendler, Kuhn, & Prescott, 2004; R. Van Winkel, Van Nierop, Myin-Germeys, & van Os, 2013). This increased stress sensitivity is thought to stem from a sensitization of the mesolimbic DA system, which leads to a heightened DA response to future stressors (R. van Winkel, Stefanis, & Myin-Germeys, 2008). Thus, if ESM is a valid measure to capture the subjective stress response, individuals exposed to childhood trauma should show an increased emotional reaction to small daily life stressors compared with non-traumatized individuals.

A few studies have investigated daily life stress sensitivity in traumatized individuals using ESM (Glaser, van Os, Portegijs, & Myin-Germeys, 2006; Lardinois, Lataster, Mengelers, Van Os, & Myin-Germeys, 2011; Wichers et al., 2009a; Wigman et al., 2013). All these studies converge on the same result; individuals exposed to childhood trauma compared to non-traumatized individuals show increased emotional and psychotic reactivity to daily life stress as adults (Glaser et al., 2006; Lardinois et al., 2011; Wichers et al., 2009a; Wigman et al., 2013). Moreover, these findings were similar using different childhood trauma questionnaires, and across samples, such as individuals from the general population (Wichers et al., 2009a; Wigman et al., 2013), patients with a psychotic disorder (Lardinois et al., 2011), and frequent GP visitors (Glaser et al., 2006).

In a sample of psychotic disorder patients, Lardinois and colleagues showed that patients exposed to childhood trauma, as measured with the CTQ, had a higher psychotic and NA reactivity to event related and activity related stress (Lardinois et al., 2011). Glaser and colleagues investigated frequent attenders of the GP without a clear somatic problem. He also reported an increased NA reactivity to event-related and activity-related stress in individuals who were exposed to severe sexual or physical abuse (Glaser et al., 2006). Two other studies used a general population sample, and an adapted childhood trauma questionnaire (the CTQ with the most explicit questions on sexual or physical abuse omitted), reporting similar findings of increased ESM stress sensitivity in traumatized individuals (Wichers et al., 2009a; Wigman et al., 2013).

3.4.2 Adult life events

Elevated sensitivity to minor stressors in daily life, as measured with the ESM, has also been investigated as a potential mechanism through which exposure to adult life events may impact on the development of mental disorder. Adult life events are commonly measured with questionnaires, checklists or interviews. So for example, the Life Events and Difficulties Schedule (LEDS) (G. W. Brown & Harris, 1978) is a semi-structured interview that allows for a very detailed assessment of life events, commonly in a 6-month or 12-month time-frame prior to interview and/or onset of a specific mental disorder (G. W. Brown & Harris, 1978). Life events are rated based on an extensive manual, case vignettes and consensus discussion considering extensive information about the nature of, and context surrounding, the life event as well as the individual's biographic circumstances. Life events can then be grouped according categories of threatening, loss, humiliation, and non-severe events as well as independent, possibly independent and dependent events (G. W. Brown & Harris, 1978, 1989). Using this and other validated measures, consistent evidence has accrued that implicates adult life events in the development of mood disorders, in particular, depression (Farmer & McGuffin, 2003; Harris, 2001; Hosang et al., 2010; Hosang et al., 2012; Tennant, 2002; Uher, 2014). Further, some evidence has emerged that life events are associated with an increased risk of psychosis (Beards et al., 2013).

Overall, there has been relatively less research on the association between life events, stress sensitivity, and mental disorders. One study by Myin-Germeys et al. (2003) of individuals with psychotic disorder found elevated negative affect and reduced positive affect in response to both event- and activity-related stress in those exposed to stressful life events, measured with the Life Events and Difficulties Schedule (LEDS) (G. W. Brown & Harris, 1978). Similarly, increased emotional reactivity to event-related stress has been reported in general population twins exposed to negative life events, as assessed by a modified version of Paykel's Interview of Recent Life Events (Paykel, 1997; Wichers et al., 2009b). While, overall, research investigating this issue has been limited in amount, what there is does tentatively suggest that elevated sensitivity to minor stressors in daily life may be underlying the association between life events and mental disorder.

Although all these studies on both life events and childhood trauma report relatively small effect sizes (i.e. small increases in stress sensitivity), these effects were measured frequently during the day, for several consecutive days, and in reaction to small daily life stressors.

Overall, these findings again support the notion that the assessment of the subjective stress response

with ESM is feasible, capturing valid and valuable indicators of the stress-response.

4. Summary and Conclusions

The current manuscript provided an overview of the evidence for the validity and clinical relevance of ESM-based subjective stress assessment. Validity was affirmed by the finding that ESM subjective distress increased after experimental acute stress induction, and seemed to directly relate to increased cortisol levels. Furthermore, increased emotional reactivity to stressful events was found to relate to structural changes associated with prolonged stress exposure, and momentary emotional stress reactivity to increases in cortisol, directly linking these subjective reports to established measures of the physiological stress response. Moreover, the sensitized emotional stress reactivity observed in several samples suffering from psychopathological symptoms, groups that are known for their heightened stress sensitivity, stipulates both the meaningfulness and specificity of these measures. On a similar note, psychotic stress reactivity as measured with ESM was found to relate to DAergic changes associated with psychosis, which not only affirms its validity as a subjective measure of stress responsiveness, but also its clinical relevance in terms of psychopathological specificity. Finally, groups associated with heightened stress sensitivity as a result of childhood trauma or the experience of stressful life events in adulthood showed an increased affective and psychotic responsiveness to daily stressors. This further affirms that ESM subjective stress measures adequately tap onto the stress response and indicate meaningful group differences.

Although we have provided compelling evidence for ESM to be a useful and meaningful tool to assess subjective stress, this does not preclude further methodological improvement. Both the assessment of the subjective appraisal as well as the stress-response could be further improved. For example, although event-related stress seems to be an indicator of subjective stress measures, it serves suboptimally as a predictor of the physiological stress response. Adding appraisals of "importance" and "control" could possibly further improve the assessment of event-related stress. A few studies inquired about negative events specifically (Did something negative happen?). This approach, however, may be more subject to response biases (which may be specifically relevant when comparing psychopathological populations. Also, very few studies examined subjective distress directly. It would be interesting to investigate whether direct assessments of feeling stressed yield similar results to our indirect approach. Likewise, no study compared ESM subjective distress measures with other measures regularly used for subjective distress assessment, such as the state-trait anxiety inventory.

This manuscript describes the construct and convergent validity as well as clinical relevance of ESM measures of subjective stress and stress response. Based on the findings reported here, ESM measures comprise a valid and useful tool to measure daily life stress.

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Assessment of Mental Stress Induced by Bad News Interview in Simulation Training for Anesthesiologists

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Abstract

Whereas mental stress induced by patient-physician interactions in simulation training of critical medical situations is widely studied, interactions between patients' relatives and physician have been few analyzed. Applying stress assessment tools (questionnaires STAI-S, NSRS and heart rate measurements), we showed that scenarios for simulation training of "bad news" interview (implying interactions between patients' family members and physician) could be elaborated so that generating mental stress for physicians' training through standardized patient technique, as in the real operating situation. Furthermore, we objectified that novice physicians perceived a higher mental stress level than experienced physicians. These results can be considered as important elements contributing to validate this kind of training in its psychological dimension.

1. Introduction

It is well known since long that simulation training of critical medical situations with high-fidelity manikins generates stress (see for example Small et al., 1999). These situations relate to the patient-physician interactions. Yet another interaction appears to be complex in Intensive Care Units (ICU), these between the physician and the patients' relatives, especially when bad news must be communicated.

This type of interviews with a family member can be simulated with minimal equipment investment by the standardized patient technique. For this kind of simulation, an actor or an actress plays the role of a patient's family member according to a given scenario "standardizing" the patient (here, the family member). The simulation situation may be therefore undertaken in the real premises of the ICU.

The aim of this study was to evaluate whether or not a psychological stress was effectively perceived by the trainees in a context of simulation training using standardized patient technique in case of bad news communicated to a family member. The evaluation was based on self-assessment questionnaires and physiological measurement. According to us, this was a relevant point that had to be analyzed in order to validate the stressful character of this type of simulations. In case of no perceived stress, the scenario or the technique would need improvement because too far from the real operating situation. The hypotheses were that mental stress would be perceived by participants and that experienced physicians would perceived this kind of stress at a lower level than novices.

2. Method

2.1 Design

The simulated situation aimed at reproducing the context of a patients' family member receiving bad news from the anesthetist. For this aim, participants, all volunteers, were individually suggested to go on to the patient simulator (manikin) and then to manage the meeting with the patient's relative.

2.2 Subjects

Twelve anesthesiologists (*N*= 12; 7 residents and 5 from the senior staff), adult and healthy, all volunteers, participated in the simulated situation.

2.3 Scenario

The scenario involved the participants individually in a simulated initial management of a severely traumatized child on a high fidelity pediatric manikin (the simulator), before having to inform one the child's parent (actor as standardized patient) of the medical situation.

2.4 Assessment

During the whole simulation, the participant's heart rate (HR) was continuously recorded providing physiological measurement of a stress indicator, HR, as studied and used elsewhere (see for example for reliability discussion: McDuff et al., 2014, and for application: Choi et al., 2009; Fauquet-Alekhine et al., 2014).

Psychological stress was self-assessed twice by the State-Trait Anxiety Inventory (state part STAI-S; Spielberger, 1983): i) just after going onto the manikin simulator and ii) just after the interview.

This was also assessed by the NSRS, numeric stress rating scale developed by Lee et al. (2010); results of this latter self-assessment were already discussed elsewhere (Lehousse et al., 2013) and will not be commented in the present paper.

In addition, the realism of the simulated situations and the involvement of the participants in the situations were evaluated by both the participant and the trainers through video post-analysis of situations. These data was discussed elsewhere (Lehousse et al., 2013) and showed that the realism of the simulation was perceived satisfactory (close to the real operating situation) and that the involvement of participants were effective, permitting to conclude that lack of realism or lack of participants' involvement could not be factors of absence of perceived stress during the simulated situation.

3. Results

The mean STAI-S score reported moderate anxiety for both simulated situations (Table 1).

Table 1: Results of stress self-assessment through STAI-S (*Sr* for residents' score; *Ss* for seniors' score; *Sa* for all participants' score) and associated significance *p*

	STAI-S scores	
	after manikin simulation	after standardized patient simulation
Sr: residents (*N*=7)	40	37
Ss: seniors (*N*=5)	36	31
Sa: all (N=12)	38	34
p (*Sr* vs *Ss*)	.15	.1

Experienced trainees (senior staff) showed a lower level of anxiety in all conditions ($p<.15$ and $p<.10$ for manikin simulator and standardized patient simulator resp.).

In addition, correlation coefficient between scores obtained with STAI-S and NSRS (Lehousse et al., 2013) was $r=.81$ ($p<.025$) illustrating a good agreement between both self-assessments.

HR varied significantly with the type of simulation ($p=.03$) and confirmed the changes of stress level from one condition to another.

4. Discussion

The assessment through STAI showed the existence of a non negligible anxiety for subjects after experiencing the simulated situations of the present study. Furthermore, this perceived anxiety appeared significantly higher for novice than for experienced participants which was consistent with expected results.

The stress self-assessment through STAI questionnaire showed good agreement with measurements of HR taken as a physiological indicator of stress. Furthermore, STAI scores showed a satisfactory correlation coefficient with another questionnaire (NSRS), both regarding conditions differentiation and subjects' experience. We therefore considered the STAI as relevant to assess the stress of simulated situations studied in the present research (see hypotheses in §1).

These findings led to validate the standardized patient technique as relevant for simulation training of patients' interviews with bad news regarding the stress dimension.

Limits of this pilot study were mainly due to the low number of participants by the side of experienced physicians. We make the assumption that additional experiments in simulation training sessions would lead to the same conclusions and would increase their significance.

5. Conclusion

Assessment of stress state of trainees, both novice and experienced, through STAI-S questionnaire and compared to other stress assessment techniques showed that simulation training of "bad news" interview could be realistic by generating mental stress for the physicians involved in the simulated situation, similarly to what was obtained for manikin simulation. As expected, a lower level of stress was obtained for experienced participants compared to novices.

Hence conclusions may be formed at two levels: i) the state assessment part of STAI questionnaire is a relevant tool for physicians' stress assessment involved in medical simulated situations, ii) scenarios for simulation training of "bad news" interview may be elaborated efficiently so that generating mental stress for physicians' training through standardized patient technique.

Additional experiments to this pilot study would be welcome in order to increase the significance of data related to experienced physicians.

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Appraisal of Life Event Scale (ALES) to differentiate mental stress perceived by Physicians and Nurses involved in the same Simulation Training situation of Anesthesiology

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Abstract

High-Fidelity simulation training of critical anesthesiology situations lead to stressful situations for trainees, usually physicians and nurses playing their own professional role in the simulated situation. A question rose among trainers of the medical simulation center of Angers (France) regarding the level of perceived stress in relation to the profession. The Appraisal of Life Event Scale (ALES) was used for self-assessment of perceived stress among two professional samples (healthy and adult physicians and nurses, *N*=85) tackling the same simulated critical situations. Statistical analysis showed that an overall approach could lead to the conclusion that the level of perceived stress was identical for both professions, but a refined analysis considering different levels of stress showed that the perceived stress was actually higher for nurses than for physicians. These results gave two main conclusions: i) trainers must be updated of this difference in order to manage it and be sure stress and context (mainly managed by physicians) will not reduce the nurses' learning capacities, ii) analysts using questionnaires for stress assessment must be warned about the trap leading to false conclusion when having an overall approach rather than an approach considering discrete levels of stress.

1. Introduction

High-Fidelity simulation training in anesthesiology may lead to stressful situations for trainees (Small et al., 1999, Müller et al., 2009; Fauquet-Alekhine et al., 2011; Aminazadeh et al., 2012; Bouhours et al, 2015): trainees are involved in scenarios implying the management of critical medical situations where the patient in simulated by a manikin (the simulator) which reproduces the physiological characteristics of a human being (breath, heart rate) set up according to a pre-elaborated scenario and responding to the trainees' actions (responses following injections); the manikin is controlled through a computer and may also speak (loudspeaker connected to a microphone allowing the trainer to play the patient's speech). Under some conditions, trainees may even be so stressed that their performance may be affected (Fauquet-Alekhine et al., 2014).

Most of the time and depending on the training center organization, the anesthesiology team trained on the simulator is constituted of physicians and nurses: each is playing the role of his/her position in the simulated situation. Regarding the simulated situation, the responsibilities of each trainee in the scenario depends on his/her position. If the responsibility of the patient's life is theoretically the same for all the members of the team, it is clear that leading the team and the decision making is the anesthetist's responsibility. Assuming that the mental stress induced in the situation is related to the level of responsibilities, a subsequent hypothesis may be that the perceived stress would be higher for the physician than for the nurse. The following question was asked to two experienced physician-trainers and two experienced researcher-work psychologists involved since more than ten years in anesthesiology simulation training: "in your opinion, whilst going onto the simulator for critical medical situation management, among the trainees, who feels the higher level of mental stress: the anesthetist or the nurse?" The answers were not converging: two said "anesthetist" due to the physician's responsibilities in the team (residents were young while nurses were rather experienced), and two said "nurse" (nurses are less used to being trained on simulator, or nurses are less expert whereas physicians are more expert and thus less stressed). A subsidiary question was asked: "who best manages the stress?" Again the answers were not converging: three said "anesthetist" (for the same reason than before) and one said "nurse" (nurses have the culture to take distance from the action when experienced).

We thus found it interesting to objectify the answer to these questions. The concern was to know whether or not the training sessions had to be adjusted to the stress management required for each position in case of misbalance of perceived stress. Indeed, if for example nurses feel a significant

higher stress than anesthetists, it may be worth to train the latter to help the former. Conversely, if anesthetists feel a significant higher stress than nurses, it may be worth to analyze situations so that to teach copying strategies to physicians.

The aim of this paper was therefore to assess the perceived mental stress induced by simulation training sessions for a sample of anesthetists and of nurses involved in the same scenarios and to conclude for possible training adjustments.

2. Method

2.1 Design

Physicians and nurses (students or experienced) were summoned in the medical training center of the university Hospital of Angers (France) in order to be trained through critical medical situations designed according to pre-elaborated scenarios. They all were involved in a progressive approach of the simulator in order to reduce the factor of stress induced by the discovery of the simulator. This implied an immersive approach of critical situation with progressive increase of the encountered difficulties. Stress was self-assessed through questionnaire and then analyzed for comparison per position.

When arriving in the training center, participants were explained by the trainers (experienced anesthetists and members of the training center staff since several years) how the session would be structured. About ten participants were expected per training day. Four to six scenarios were played per day, each involving two to three participants. Each participant played a role in accordance with his/her profession. During the scenario lasting about 15 minutes, the situation was video transmitted in the debriefing room, next to the simulated resuscitation room, where participants not involved in the simulated situation could watch what was done by the trainees in situation. Just after each situation, participants leaving the simulator were asked to fill the questionnaire for stress self-assessment for later analysis. Then a collective debriefing took place.

2.2 Subjects

Participants were residents (*N*=45, 32% male, 25 to 35 yo. with average 27.5 yo.) and nurses (*N*=40, 21% male, 20 to 57 yo. with average 32.8 yo.), healthy and adult subjects, all volunteers.

A written informed consent was signed by each participant and the present study obtained the agreement by the Chair of the Ethics Committee of the Dept. of Social Psychology of the LSE (UK).

2.3 Scenarios and apparatus

The scenario involved the participants in different simulated situations on a high fidelity manikin (the simulator) as already written in §1. The simulator was made up of a computer-controlled manikin representing an adult patient lying on the bed, equipped with devices simulating respiration, cough, vocalization and also heart tones and palpable pulses, chest wall motion, permitting interactions such as bag-mask ventilation, intubation and chest tube insertion or cricothyrotomy. A connected monitor replicated the patient's responses to interventions giving a picture of the pathophysiology.

The scenarios used for simulated situations were:

1 – Cardiac arrest : *one hour after spinal anesthesia, the patient has a cardiac arrest (CA). This CA is caused by a relative hypovolemia due to overdose of intrathecal injection. Resuscitation must include the management of this hypovolemia (etiological treatment) and the CA management (symptomatic treatment)*

2 – Difficult intubation : *a patient must undergo an emergency general anesthesia with intubation. This intubation is not possible and the patient can not be ventilated properly. The treatment is an emergency tracheotomy because other ventilation maneuvers are ineffective.*

3 – Laryngospasm : *during general anesthesia induction, an one year child presents a complete reflex obstruction of his airway, leading to an acute lack of oxygen.*

4 – Traumatic head injury : *a patient presents disorders of consciousness after a traumatic head injury. His condition rapidly progresses to coma due to intra cranial hematoma. The expected support includes symptomatic treatment (emergency airway management) and rapid organization of a brain imaging for an emergency surgery.*

2.4 Stress assessment

Psychological stress was self-assessed by means of the Appraisal of Life Event Scale (ALES) just after going onto the manikin simulator (see Appendix). This scale was elaborated and validated by Fergusson et al. (1999).

The questionnaire consisted of 16 adjectives helping the subjects to rate the immediate experienced situation on a Likert scale. For this aim, the questionnaire formulates explicitly that the stress assessment relates to "the activity you were involved whilst going onto the simulator".

For each subject, a total score was calculated by summing the circled answers and a mean score was

then calculated per profession sample for comparison. The distributions of the individual scores were also compared per profession and their similarity assessed through a Kolmogorov-Smirnov test with additional statistical analysis to characterize the (dis)similarity.

3. Results

Considering the whole set of individual data per professions, the perceived stress did not show any significant relationship neither with gender, nor with age and nor with professional experience.

The mean score Q_i per profession (i=p for physician and i=n for nurse) was quite similar: $Q_p(N=45)=23.45$ ($p<.001$) and $Q_n(N=40)=23.43$ ($p<.001$).

Yet the distributions of scores per professions were different; they are given on Fig. 1. It shows a difference significantly quantified by a Kolmogorov-Smirnov value calculated for 5 modes: $D=6$ for $D_{crit}=.24$ ($p<.01$) with a significant extreme for anesthetists illustrating a high proportion of subjects with a score included in the score interval [15; 25].

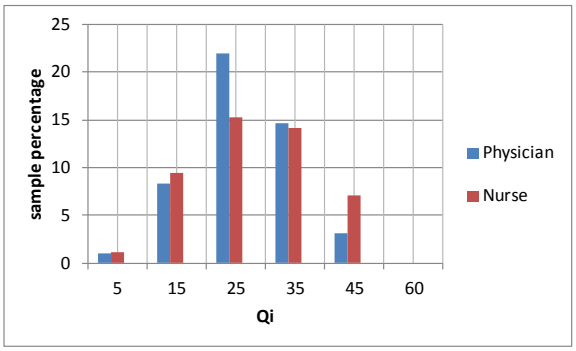

Fig. 1. Distribution of ALES scores Q_i per profession

When dividing each professional sample in two groups (subjects having an ALES score less than the mean value and these having a score higher) it showed no significant difference per profession for the low value groups through a t-test of Student ($p<.2$) and conversely a significant difference for the high value groups ($p<.035$) with a higher perceived stress for nurses than for anesthetists.

4. Discussion

4.1 From the data standpoint

The results obtained showed that none of the two professions perceived a higher stress in the average, but the analysis of the modal distribution (Fig. 1) showed that the anesthetists were mainly concerned by an ALES score close to the overall mean score by low values whereas the nurses appeared being concerned mainly by values over the overall mean score. Furthermore, a significance difference was statistically objectified for the upper half part of the score values with higher perceived stress for nurses than for anesthetists.

These findings permitted to conclude that the perceived stress was similar for anesthetists and for nurses when subjects were considered altogether per professions, but that there were more nurses concerned by high perceived stress than anesthetists, and that the level of stress perceived by nurses in this high stress zone was significantly higher for nurses than for anesthetists.

Hence the conclusion was that nurses perceived a higher stress than anesthetists. Furthermore, in case of stressors more intensive for anesthetists than for nurses (this cannot be assessed in the present study) then the results would lead to the assumption that anesthetists better manage stress than nurses.

4.1 From the analysis standpoint

Furthermore, the analysis undertaken in the present study questions the way data could be analyzed. It was clear that the average values of the ALES scores gave an inaccurate estimation of the perceived stress per profession. At the opposite, Fig. 1 showed that the values spread over a large range, suggesting that considering the values at the individual level would make it difficult to emphasize any trends. This is actually the case. Between these two farthest approaches, the approach considering data per modes and by sub-samples at different level of perceived stress appeared to be more relevant in helping us to extract from data interesting information.

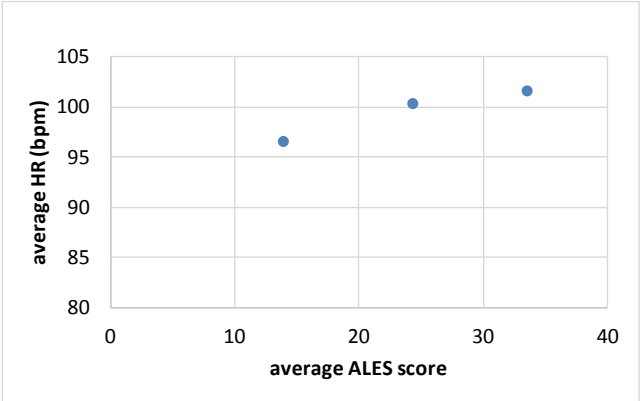

Fig. 2. Average HR vs average ALES score for N=20 physicians

For example, for some of the physicians (N=20), average heart rate (HR) was measured using a Polar

FS2c (accuracy of time measurement: better than ± 2.0 s / 24 h; accuracy of heart rate measurement: ± 1% or ± 1bpm, whichever larger; measuring range: 15-240 bpm) and then compared with the ALES score. Whereas considering individual data did not provide any clear trend leading to a conclusion, proceeding per range appeared more efficient: an average score was calculated for intervals [0; 20], [20; 30] and [30; 40] and the associated average HR was also calculated. The results drawn Fig. 2 showed that HR actually increased with the average ALES score, i.e. with increasing perceived stress as expected (e.g. MacDuff et al., 2014).

5. Conclusion

Two samples of trainees (anesthetists and nurses, healthy and adult) were involved in the same scenarios on high fidelity manikin simulator for critical anesthesiology situation management. Stress was self-assessed through the ALES questionnaire (Fergusson et al., 1999). Whereas the overall ALES mean scores per professions showed a quasi-identical level of perceived stress, a refined analysis bases on a modal approach emphasized a significant higher level for nurses than for anesthetists and that the anesthetists possibly better manage stress than nurses.

Compared to the hypothesis made at the beginning of this study making us think that the nurses' stress might be underestimated by trainers (and thus not taken into account at its right level and managed appropriately by the trainers), these results engage to warn the management and the trainers of medical training centers to be careful with regard to this point. The risk not to consider the nurses' stress at its actual level would be to let them be trained and reach a state of stress higher than a performance threshold leading them to work in a zone of cognitive deficit (Yerkes & Dodson, 1908; Fauquet-Alekhine, 2012), thus disturbing the learning process.

Acknowledgement

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Appendix

The Appraisal of Life Event Scale (ALES) by Fergusson et al. (1999)

Copy of the questionnaire used in the present study

Thank you for filling this questionnaire by ticking the more appropriate answer for each question.

In the following, we shall call "event" the activity you were involved whilst going onto the simulator.

State how each of the adjectives of the following list described the best your perception of the event at the time it took place by encircling one of the number of the 6-point scale:

0 1 2 3 4 5 corresponding to the extremes: 0 = "not at all" and 5 = "extremely"

At the time the event took place, it was:

		Not at all	No	Rather no	Rather yes	yes	Extrem -ely
1	threatening	**0**	**1**	**2**	**3**	**4**	**5**
2	challenging	**0**	**1**	**2**	**3**	**4**	**5**
3	intolerable	**0**	**1**	**2**	**3**	**4**	**5**
4	fearful	**0**	**1**	**2**	**3**	**4**	**5**
5	enjoyable	**0**	**1**	**2**	**3**	**4**	**5**
6	painful	**0**	**1**	**2**	**3**	**4**	**5**
7	worrying	**0**	**1**	**2**	**3**	**4**	**5**
8	stimulating	**0**	**1**	**2**	**3**	**4**	**5**
9	depressing	**0**	**1**	**2**	**3**	**4**	**5**
10	hostile	**0**	**1**	**2**	**3**	**4**	**5**
11	exhilarating	**0**	**1**	**2**	**3**	**4**	**5**
12	pitiful	**0**	**1**	**2**	**3**	**4**	**5**
13	frightening	**0**	**1**	**2**	**3**	**4**	**5**
14	informative	**0**	**1**	**2**	**3**	**4**	**5**
15	terrifying	**0**	**1**	**2**	**3**	**4**	**5**
16	exciting	**0**	**1**	**2**	**3**	**4**	**5**

High stress and Self-assessment: Assumption of Systematic Over-estimation

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Abstract

The use of questionnaires for self-assessment of stress is broadly applied within the scientific community, often complemented with physiological measurements. A few cases of over-estimation of perceived stress using such questionnaires with healthy adult subjects were reported; most of the time, this point is never questioned in the articles. It thus appeared interesting to undertake experiments in the aim of characterizing the possible deviation regarding self-assessment through questionnaires. Peritraumatic Distress Inventory (PDI) questionnaire was used for self-assessment of short term mental stress for two cohorts of subjects (*N*=19) (residents in anesthesiology working in hospital and charter engineers working on an industrial plant) having experienced stressful situations during which mean heart rate was measured. The PDI scores obtained were compared to expected values using the Fauquet-Alekhine et al.'s model for HR response under mental stress. The resulting significant deviation observed was confronted to four assumptions which led to conclude for an effective over-estimation due to the subjects' perception occurring for high level of stress.

1. Introduction

Assessment of stress is a key point in many research domains: for instance it is investigated in terms of factor of performance (Osler, 1954; Van Gemmert et al., 1997; Drach-Zahavy et al., 2002; Beilock et al., 2004, 2007; O'Connor et al., 2010; Jo et al.; 2013), of pathological factors (e.g. Hayes et al., 2009; Combs et al., 2015), studied when combined with tiredness (Harjumaa et al., 2015; Hodgson, 2016) or related to sleepiness (Woodward et al., 2009; Cho et al., 2013). Different kinds of stress were thus identified and therefore studied such as chronic stress (e.g. Maslova et al., 2002 ; Wolf et al., 2008 ; Schubert et al., 2009) or short term stress (e.g. Schubert et al., 2009 ; Fauquet-Alekhine et al., 2014), both including physical or mental dimensions.

Two ways are possible for stress assessment: subjective or objective; however, both are indirect ways of stress assessment. Subjective assessment relates to the use of questionnaires and provides an assessment of stress through its perception by the subjects. Objective assessment relates to the use of physiological measurements and provides an assessment of stress through the reaction of the subjects' metabolism. Therefore in both cases, only consequences of stress are accessed.

Whereas objective assessment may be considered as not being distorted by the subjects, reflecting the actual reaction of the subjects' metabolism to stressors, the distortion might be effective for subjective assessment due to the facts that questionnaires are not filled during the stressful episode but after and due to the subjective nature of perception. In this case we are considering scientifically validated questionnaires, not arbitrary scale of stress self-assessment based on one question which has not been subjected to a validation process (about this latter point, see the analysis of Fauquet-Alekhine & Rouillac, 2015).

This assumption of distortion regarding self assessment of stress was clearly observed in a previous work (Fauquet-Alekhine et al., 2014).

Data was collected regarding training of residents in anesthesiology. They tackled situations of medical training on full scale simulator. The situations lasted from 10 to 15 min. during which subjects had to deal with scenarii among which some of them required cardiac massage, thus involving physical effort. The subjects' heart rate increased due both to the mental stress and the physical effort provoked by the situation. Subjects were asked to assess their stress by means of Peritraumatic Distress Inventory questionnaire (Brunet et al., 2001) and the scores (Q_{mean}) were compared to the mean heart rate (HR_{mean}) measured during the situation. Data (plotted on Fig. 1) clearly showed a shift of some points towards higher values of Q_{mean}, suggesting an overestimation of self assessment of stress for the highest values.

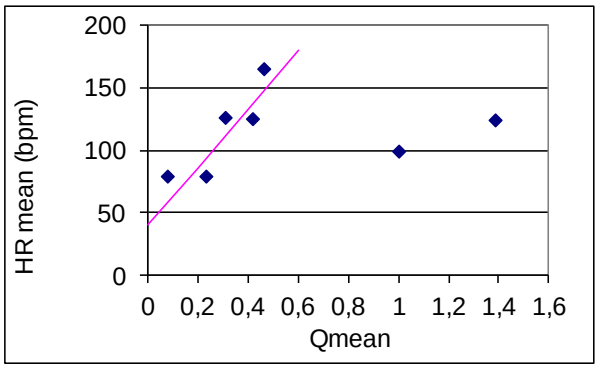

Fig. 1.Mean heart rate vs scores of PDI questionnaire for residents in anesthesiology experiencing a stressful situation during simulation training.

The present short paper aims at illustrating this possible over estimation of self assessment of mental stress through questionnaires after experiencing stressful conditions.

2. Material and methods

Experiments were carried out with French subjects. They had two different professional profiles and all tackled stressful situations; they are described §2.3. Stress state was self-assessed through validated questionnaires (§2.1) and through heart rate measurement as a physiological parameter (§2.2).

2.1 Stress self-assessment

Peritraumatic Distress Inventory questionnaire (PDI questionnaire) was chosen for self-assessment of stress because it includes items such as frustration or guilt in not doing more, shame, fear for one's safety or for that of others, which were important parameters regarding the stressful situations that were encountered by the subjects. It also includes the subject's feelings regarding physiological parameters (sweating, shaking, pounding heart). This questionnaire was elaborated by Prof. Brunet's team in order to obtain a quantitative measure of the level of distress experienced during and immediately after a traumatic event (Brunet et al., 2001). It was validated in its French form (see Jehel et al., 2005, 2006).

In order to gauge possible bias due to the PDI questionnaire, a cohort of the subjects answered the ALES questionnaire and scores obtained with PDI and ALES were compared. ALES, Appraisal of Life Events Scale was elaborated by Ferguson et al. (1999), with 16 items with reference to the four primary evaluation forms described by Folkman and Lazarus (1985).

Questionnaires were fulfilled by the subjects just after tackling the stressful situation.

2.2 Physiological measurement for stress state assessment

Heart rate was measured by means of a Polar FS2c composed of two parts. The first one was a detector with two electrodes to be put on the breath, touching the skin, close to the heart. The second one was a monitor the size of a watch worn on the wrist. The technical specifications were:

- accuracy of time measurement: better than ± 2.0 s / 24 h
- accuracy of heart rate measurement: ± 1% or ± 1bpm, whichever larger
- measuring range : 15-240 bpm

Heart rate (HR) was measured for each subject whilst tackling the stressful situation and the average value HR_{mean} calculated all over this time was saved for further analysis.

2.3 Stress conditions and subjects

All subjects were healthy adult volunteers without any mental or physical disability.

2.3.1 Comparing PDI and ALES response

Volunteers subjects, *N*=44 (mean age: 27.5 yo., 68% male), were asked to fill ALES and PDI

questionnaire just after experiencing a stressful anesthesiology training session on a full scale simulator. Individual scores were calculated for inter-comparison.

2.3.2 Analyzing HR vs PDI score

Two cohorts of subjects (N_{total}=39) participated to the study.

The first cohort (21 participants) was residents in anesthesiology working in hospital with age ranging from 25 to 30 yo. They provided data among which some of them had to be rejected. The rejection criteria were: i) when subjects had involved themselves in physical efforts (e.g. cardiac massage) with thus a possible bias on HR measurement (this was observed during the simulated situation), ii) when subjects had coffee (or stimulating beverage), tobacco (or stimulating substances) or had experienced a stressful situation before coming to the experiment (this was investigated through a questionnaire). This cohort tackled situations of medical training on full scale simulator as described in Fauquet-Alekhine et al. (2014). The situations lasted from 10 to 15 min. during which subjects had to deal with one of the following scenarii: i) a compressive cervical hematoma in a 43 yo. patient after thyroidectomy in the recovery room, quickly leading to asphyxia, ii) local anesthetic toxicity after regional anesthesia in a 64 yo. patient undergoing total shoulder arthoplasty with frequent PVCs (premature ventricular contractions) followed by asystole, iii) the occurrence of profound hypotension after induction in a 70 yo. patient treated by an angiotensin converting enzyme inhibitor, complicated by a third degree atrioventricular block due to myocardial ischemia, iv) an error in drug administration (muscle relaxant instead of midazolam) before a regional block performed in a 27.0 yo. patient resulting in a respiratory arrest, v) Anaphylactic cardiac arrest after succinylcholine administration for rapid-sequence induction with a patient being a young man with emergency surgery treatment for leg injury, vi) Hemodynamic deterioration after increase of pneumothorax (failure of central venous access) which needs for emergency exsufflation for a 30 yo. man sedated for postoperative hypothermia in after a right nephrectomy.

The second cohort (18 participants) was chartered engineers working at an industrial plant with the same kind of academic background with ages ranging from 25 to 35 yo. It was verified that none of them had coffee (or stimulating beverage), tobacco (or stimulating substances) or having experienced a stressful situation before coming to the experiment. In their own office, subjects individually tackled a stress-test (an office task type not implying any physical effort) made up of 12 psychotechnical and cultural questions, lasting from 5 to 10 min., said stressful or not depending on contextual factors added for the test (see full details in Fauquet-Aleklhine et al., 2012).

2.4 Data analysis

As suggested by Berton et al. (2015), the data was treated by range: an average score $Q_{PDImeas}$ was calculated for intervals 0.2 width and the associated average *HR* was also calculated. Then, for each *HR* calculated, an expected score was calculated as follows.

Figure 1 illustrates a case of *HR* variation with Q_{mean}, the score per subject, when perceived stress is assessed through the PDI questionnaire. The graph shows a deviation of data for some of them towards the highest levels of stress. However the graph illustrated this deviation with reference to a linear line while heart rate does not evolve linearly with a stressor: Levy et al. (1998: 1237) pointed out this fact and this was highlighted again, mathematically modelized and tested by Fauquet-Alekhine et al. (2016) who showed that heart rate variation with an indicator of stress (such as a score of the PDI questionnaire) actually follows a power trendline which is generalized through a unique power coefficient *a*. The model takes the form:

$$HR = kS^a + c \qquad (1)$$

where :

- *S* is a stress indicator (as the score of the PDI questionnaire),
- *c* is the y-intercept of the curve,

with:

$$k = {}^{\alpha}/_{a\ S_1^{(a-1)}} \qquad (2)$$

where:

- α is the slope of the linear function linking HR_1 and S in the neighborhood of 0,
- $a = .2$
- S_1 is adjusted to 15% of the range of experimental data covered by the linear function (HR and S in the neighborhood of 0).

The model correlated with 8 different studies providing 24 points gathering altogether 295 healthy adult subjects and involving 6 different stress indicators was r=.95 (p<.0001).

In the present study, Fauquet-Alekhine et al.'s model for HR response under mental stress (eq. 1) was applied to the collected data in order to calculate the expected scores $Q_{PDIcalc}$ of the PDI questionnaire and compare them with the values $Q_{PDImeas}$ obtained.

2.5 Ethics

Deontology was presented during each introduction of training sessions or experiments to the subjects. All subjects were volunteers. It was clearly explained that all data would be used for research, anonymously, and that no access to personal data or to the links between data and identity would be given to anyone. An informed consent was filled up and co-signed by each subject and the researcher each time.

3. Results

3.1 Comparing PDI and ALES response

The ALES questionnaire offers the possibility to differentiate stress factors referring to excitement from those referring to constrain. As the PDI questionnaire items only refer to constrain, the ALES score was calculated only taking into account the items of constrain. The correlation coefficient with the PDI questionnaire for N=44 subjects was significant: $r(N=44)=.70$, p<.001. When gathering data per intervals according to the PDI values ([0;1];]1;3];]3;5];]5;7];]7;10]) the correlation coefficient was higher: $r(N=6)=.89$, p<.008.

This permitted to reject the hypothesis that a questionnaire bias could explain a possible over (or under) estimation of stress.

3.2 Analyzing HR vs PDI score

For the first cohort (residents), after applying the selection criteria for the 21 participants summoned, the remaining selected subjects were N=11 (50 % male, mean age: 28 yo.). The Cronbach coefficient calculated for this remaining sample regarding answers provided for the PDI questionnaire was α=.63.

For the second cohort (chartered engineers), after applying the selection criteria for the 18 participants summoned and taking into account that some subjects perceived a level of stress too low differentiated by the PDI questionnaire (thus yielding a bias due to statistical weight), the remaining selected subjects were N=8 (38% male, mean age: 31.5 yo.). The Cronbach coefficient calculated for the remaining sample regarding answers provided for the PDI questionnaire was α=.66.

For both cohorts, data was treated by range: an average score $Q_{PDImeas}$ was calculated for intervals of 0.2 in width and the associated average HR was also calculated. The expected score $Q_{PDIcalc}$ was calculated for each HR using Fauquet-Alekhine et al.'s model for HR response under mental stress (eq. 1).

Figure 2 draws the score $Q_{PDImeas}$ vs $Q_{PDIcalc}$ for each cohort on the same graph. If the PDI scores would be as expected, all points would be aligned over the linear line $y=x$ intercepting 0. This is the case for the low values of scores but very soon the points deviate from this line which clearly shows a higher score than expected.

4. Discussion

The deviation appearing on Fig. 2 accounts for an obvious trend towards higher values than expected when subjects scored high levels of stress. It is remarkable that the trend is similar for both cohorts despite different occupational profiles as well as different stress contexts.

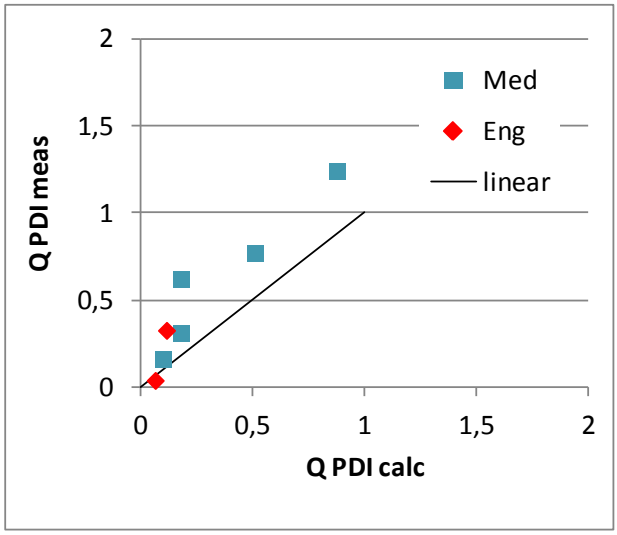

Fig. 2. Measured PDI scores $Q_{PDImeas}$ vs expected PDI scores $Q_{PDIcalc}$ for subjects (Med=residents; Eng=charter engineers) experiencing a stressful situation lasting from 5 to 15 minutes.

Several assumptions may be suggested to explain this deviation. This may be due to:

- the physiological parameter chosen to characterize stress: HR could underestimate the level of stress and therefore lead to lower expected values of PDI scores. However, on one hand a previous work (Fauquet-Alekhine et al., 2016) showed that this parameter was relevant and reliable and on the other hand the low values of stress give points aligned on the linear line.
- the inappropriateness of the model used to calculate expected PDI scores. However the aforementioned previous work showed the reliability of the model.
- a distortion intrinsic to the PDI questionnaire. However self-assessments through PDI were compared with these obtained through ALES and gave good correlation coefficients.
- the subjects' perception of stress engaging them to over-estimate the stress when the level of stress increased over a given threshold. In other words, when stress became high, subjects could have a tendency to perceive it higher than it was and then over-scored it on the scale of the questionnaire.

Among these assumptions, only the last one may be retained. In addition, this assumption is reinforced by findings obtained elsewhere: cases of overestimation of stress through recalls of stressful events were already noticed by Gittins et al. (2015) regarding individuals who experienced a traumatic event in forensic settings and by Archer et al. (2005) in the frame of assessment of pediatricians in training who rated twice higher their inability to deal with stress when compared with observers' evaluation.

Therefore the finding is that there is effectively an over-estimation of stress for high levels when self-assessed through a questionnaire by subjects who just experienced a stressful situation.

Further analysis is needed now to investigate the factors that contribute to this over-estimation.

5. Conclusion

The experiments undertaken with healthy adult subjects showed an effective over-estimation of self-assessment of short term mental stress whilst using the Peritraumatic Distress Inventory (PDI) questionnaire. Analysis showed that using the Appraisal of Life Events Scale (ALES) would have led to the same conclusions. Analysis showed that this over estimation was due to the subjects' perception occurring for high level of stress. Yet the limits of the present study lie on the reduced scope of questionnaires used: a systematic investigation of the available questionnaires would be welcome.

However the main conclusion of this study is that researchers must take into account such a possible over-estimation through questionnaires and the possible bias induced subsequently on their data, even if the deviation was observed here only for high levels of stress.

The questionnaires used in the present study being made of items which may be categorized, this may permit to characterize the overestimation through categories of the questionnaire items. Therefore, as a research perspective, a refined analysis of questionnaire scores may be carried out in order to better understand what make subjects overestimating the stress. As two different professional populations were involved in this study, this may provide lights regarding the nature

of the overestimation when, for example, confronted to occupational personality traits.

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Stress assessment in Psychiatry: Interview vs Questionnaire

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Abstract

Based on twenty years of experience in working as a psychiatric practitioner, I discuss benefits or the drawbacks of questionnaire use compare to the interview in psychiatry when receiving patients. My experience shows that questionnaires may sometimes be useful to characterize particular points but however they are only complementary tools for the interview.

Introduction

This is a compilation of approximately twenty years of experience in working as a psychiatric practitioner in both inpatient and community mental health settings. Subjects consist of a mixture of child, adolescent, intellectually disabled, and adult individuals.

The article first presents briefly the context of this work experience, then describes my practice emphasizing the benefits or the drawbacks of questionnaire use compare to the interview.

1. Psychiatric context – Stress types

2.1 Stress and the Development of Mental Illness:

Prior to the initial diagnosis of most mental illnesses, there is a precipitating factor. Current evidence suggests that some of the more serious mental illnesses, such as Schizophrenia, Bipolar Affective Disorder, and Major Depressive Disorder have both a genetic and an environmental component. (see for example Hernandez & Blazer, 2006; Weir, 2012). Individuals with these illnesses are believed to inherit a risk of developing these disorders, but a stressful event in the environment is believed to trigger the onset of symptoms (Ciccheti & Cohen, 2006). Depending on the degree of genetic loading, this event may be relatively insignificant, or can be traumatic. The triggering stressful event is often non-specific.

Based on my experience, I have noticed that these events can consist of either positive or negative stressful conditions, or of physical illnesses. Some examples include: childbirth (hormonal changes producing stressful physical challenges to the body), entry into university, starting a new job, starting a new relationship/ marriage, ending a relationship/ divorce, moving away from home, prolonged physical illness (even a prolonged case of the flu although this is uncommon), substance use, or stressful working conditions (e.g. prolonged work hours – this can vary with individuals).

Practitioner's experience:

> I had one patient who became psychotic, almost to the point of hospitalization, any time she worked more than 40 hours a week; however, her job required all the employees to work 6 days a week at 10 hours per day, as long as she worked less than 40 hours per week, she was able to function normally and without any symptoms of illness.

I have seen others who become unwell and require hospitalization after working more than 20 hours per week; other people can manage 50 hours per week, but develop mental illnesses if they have to change shifts.

Other examples include increased work load, having to work in dangerous circumstances without support.

Practitioner's experience:

> One common situation is working with aggressive patients and not having adequate training or facilities to reduce the assaults on staff.

Admission to mental health units most commonly occurs as a consequence of:

- Cessation of medications
- Increased substance use
- A stressful event

2.2 Medications

The medications used in treating mental illness, not only affect how the mind processes information, so that it can do so more effectively, they are also major tranquilizers. It could, potentially be conceived that these medications, at least partially, assert their effects by exerting a strong calming influence on the mind when it is overly stressed. They have also been noted to work effectively in treating severe anxiety, even though they are not generally licensed to do so.

2.3 Coping strategies

During my work in the community, I have been able to reduce the number and frequency of inpatient admissions by teaching patients and their support workers to limit the amount of stress. This is done by encouraging a daily routine, engaging in exercise, and teaching positive coping strategies. I've noticed that individuals without any sort of routine tend to over-utilize substances and ruminate on negative thoughts. Volunteer work or social activities tends to distract them from these thoughts and provides a sense of purpose. The time spent in these activities; however, is limited and based on what the individual can tolerate. Exercise is known as one of the best methods to counteract stress. Toxins build in the body when exposed to stress and are only eliminated successfully via exercise. This also releases endorphins which are a positive response to stress. Teaching meditation, cognitive re-structuring, and other healthy mental defense mechanisms further assists individuals to re-evaluate stressful situations.

I've noticed that sleep is one of the first symptoms of an imminent relapse of a major mental illness. When this is disturbed, generally through a lack of sleep, symptoms begin to emerge. I've also noticed that when the sleep cycle returns to normal, the individual is close to becoming well and being able to re-integrate into the community. The effects of stress on the sleep cycle and vice versa would be well worth studying.

3. Evaluate for Stress

3.1 Questionnaires contribution

Because there are many psychiatric and psychological illnesses that can present with similar symptoms, it can be difficult to tease apart what is the essential root of their problems.

One problem with questionnaires, is that they provide only an outline of the potential issues related to stress and are too often used as diagnostic tools rather than screening tools. This leads to inaccurate diagnosis and then to inaccurate treatments.

When people come to a clinician (e.g. psychiatrist/ therapist/ general doctor) for help, it is because of a specific problem and not necessarily because they feel stressed. Most people want to try to solve their stressful situations independently, although there are some, especially those with certain types of personality disorders, who will attempt to get other people to solve their problems for them. Sometimes, these people will resort to extreme forms of manipulation, including severe self-inflicted injuries, in order to access this assistance.

The most common types of problems that people, who are under stress, come to seek assistance for, are: depression, sleep disturbance, anxiety, or diminished ability to function in work/ social settings. General practice doctors often refer patients who have medical complaints, but are under stress. Sometimes medical illnesses are overlooked because the symptoms are attributed to stress rather than a physical problem. Of concern is that many physical illnesses are generated or exacerbated by stress.

When interviewing patients related to these issues, starting questions, which are then developed into stories by adding detail, can be helpful in determining treatment.

3.2 Interviews contribution

When interviewing patients related to these issues, starting questions, which are then developed into stories by adding detail, can be helpful in determining treatment.

3.2.1 Initiating the Assessment

Begin by asking patients how they are feeling emotionally. Many people are not comfortable or literate when it comes to identifying their emotions. Asking them how they feel usually gets a response describing physical symptoms. Many people, if they can only respond at all, have a basic language skill and can only identify: happy, sad, or angry. Sometimes asking them to rate this as very sad, a little sad, neither happy nor sad, a little happy, or very happy, helps them to better describe what is happening to them. Adding other related words, that they can identify, can be helpful as well, such as "frustrated, disappointed, worried, etc." A questionnaire might be helpful if it had a list of words that a person could circle to identify his/ her emotion/ emotions and then a rating scale of 1 - 10 or 1 - 5 to describe how intensely they felt that emotion (e.g. Fergusson et al., 1999). A more advanced scale would allow patients to identify more than one emotion.

3.2.2 Key Symptoms

Sleep is often the first and most prominent symptom when people are suffering from a major mental illness or from stress (e.g. Woodward et al., 2009; Cho et al., 2013). A good sleep history can be critical in both diagnosing and treating stress/ mental illness.

Ask: Do you have problems with sleeping? What kind of problems do you have? (e.g. falling asleep, staying asleep, or waking too early?)

If falling asleep: how long does it take? Hours/ minutes/ seconds? (30 minutes is considered normal; however, many people think more than 5 minutes is abnormal). What contributes to this? - e.g. TV, worried thoughts, happy thoughts, planning for tomorrow, having too much energy, ruminative thoughts, restless legs, feeling too hot/ cold, partner snoring, etc. I do not think a questionnaire would be able to target all of these. What time do they go to bed? What time do they go sleep after getting into bed? What time do they wake up? Do they wake up with or without an alarm? Then calculate the actual hours. (Many people report sleeping problems because they go to bed at midnight after watching TV, but have to get up at 6 for work. They then call in sick for work because they are too tired, but will sleep until 10 a.m. This is generally not stress, but is a problem with lifestyle.) How do you feel when you wake up? Do you feel rested a few minutes/ or an hour after you wake up naturally (without an alarm). If the answer is "yes", it is not likely to be stress. If the answer is "no" then it could be stress, but not necessarily.

If it is worried/ ruminative thoughts, then I proceed to review for stressful events which could be contributing to diminished sleep.

Is there anything in your life that is taking up a lot of your attention, either good or bad? (it is important to review for happy stress in addition to unpleasant stress. For example planning for a wedding, graduation, new job, promotion, or extensive travel can also be stressful even though these are associated with pleasant thoughts and people often do not associate them with being stressed). On a questionnaire, this would have to be a fill in the blank, but could also have a few examples so as to get people thinking. I've found most questionnaires are too limited, but questions that are too open ended often confuses people so that they do not answer anything, but feel that the interview/ questionnaire is a waste of time.

Concentration is also often diminished in stress/ mental illness (e.g. Hayes et al., 2009; Combs et al., 2015). In mania, people cannot concentrate because they are being flooded with lots of ideas and thoughts, most of which are positively experienced. People who are depressed cannot concentrate because they are also either flooded with thoughts that are unpleasant so that they cannot focus on the issues at hand, or because they have no thoughts at all.

How is your concentration? Have you seen a change in your ability to perform at work/ school. Are you having trouble remembering information that you used to remember easily? How long does it take you to complete an assignment? How long does it take colleagues? (This has to be asked carefully because people with OCD or with ADHD can have initial responses that are similar to people who are depressed or stressed. Additional questions have to be asked to determine the difference). How long would it have taken you to complete that assignment/ project 6 months ago or 1 year ago? (This helps to identify progression of symptoms. OCD and ADHD are likely to be consistent. Stress and Depression are likely to worsen with time or to be dependent on conditions within the environment).

Have you noticed problems with day to day activities? Some examples may be: getting distracted during driving, problems preparing meals, forgetting to turn off the stove, misplacing items around the house, etc. It is important to note to the patient that all people do this from time to time, but people tend to do this more frequently when they have stress, depression, ADHD, or dementia. If they had a previous history of good functioning, then it is not likely ADHD. If they are not elderly and it is episodic, it is not likely dementia.

Physical Ailments are a very common sign of stress (e.g. Al-Baldawi, 2002; Segerstrom & Miller, 2004; Kane, 2009; Nakao, 2010; Madhura et al. 2014). We know that when people are under either emotional, mental, or physical stress, this can produce changes in the body's chemistry and immune system which can create physical illness.

Do you have any physical problems? What kind? Here, a list of general physical parts of the body would be helpful in a questionnaire. (e.g. stomach, digestive tract, heart, breathing, bone & joint, etc.) The digestive system is the most commonly affected, and heart is probably second, although any system, including hormonal, can be affected. Is this causing you problems in your daily life? If so, it what way?

Social Interactions are commonly affected when people are under stress (e.g. DeLongis et al., 1988). This can be demonstrated in many different ways.

How is your social life? Do you have any friends? How often do you get together with friends? Has this changed over the past 6 months? 1 year? If so, how? (Note: some people may be more social. Generally, this would not be attributed to stress; however, people who are needy may be seeking other people who are enablers or rescuers so they may be more social.) What things do you do for fun? How much time do you spend relaxing/ enjoying yourself?

What is the quality of your current social contacts? Are you having an increase in arguments? Are your friends starting to avoid you? Are you seeking help/ advice more often than you normally would? Are friends/ family becoming critical? Are friends family becoming more annoying? (Often people do not perceive that they are the source of the conflict, but will interpret other people's reactions, to their stress, as being annoying/ unfair/ critical).

A review of **Coping Strategies** can be useful in evaluating whether or not someone needs assistance with managing their stress. Some people are very well equipped to manage their stress and do not require a referral to a specialist, but may be undergoing a very intense amount of stress, just as a consequence of living.

How are you coping with your current situation?

How do you usually cope with stress?

What skills do you utilize when you face a problem in life?

Again, this could use a few multiple choice and a fill in the blank. (E.g. Exercise, meditate, pray, eat sweets/ junk food, talk to someone I trust, sleep so I do not think about it, worry and hope it will resolve on its own, try not to think about it, distract myself with happy thoughts, distract myself with work, drink or use drugs, engage in sex, re-think the problem so that it is not so overwhelming, break the problem down into small parts that I can solve a little at a time, remember past experiences when I've had problems and they did not last, consider suicide/ or harm myself, put off doing anything until the problem gets too big, etc.)

Do these strategies work for you?

What things work, and what things do not?

Do you feel hopeful that things will get better? (This is a crucial question).

4. Conclusion

Pointing out potential or experienced problems using questionnaires regarding my personal psychiatric practice, I tried in this article to describe the possible complementarities of questionnaires and interviews in psychiatry, even though I argued that interviews remain the main tool to better help practitioners to understand patients' state.

I described how questionnaires could particularly complement interviews; this description was based on my own experience.

I found that questionnaires could be relevant to quantify intensity of patients' emotions and help practitioners to describe how intensely they felt that emotion. I suggested that this could also be the case for the description of perceived physiological key symptoms.

Conversely, I found that questionnaires would be of poor help to describe, characterize and finally help practitioners understanding most of the psychological key symptoms.

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Training for Techniques of Stress Management

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Abstract

It is difficult to learn to swim by reading a manual of swimming. At one time or another, you must throw yourself into the water. And the sooner the better. The theoretical explanation afterwards will support and enlighten experience. Or not. It is the same for stress management. Teaching these techniques is a difficult art. The theoretical temptation, the desire to define and control perfectly a living phenomenon, the belief in the power of the methods are all traps to avoid. The purpose of this article is to highlight traps and teaching secrets of teaching techniques of stress management.

Keywords: stress, stress management, training, cost

1. Introduction

Stress is a real problem of our time.

Is it really necessary to recall the human and economic cost?

In France, work-related stress costs more than one billion euros per year. For all of the states of the European Union, the cost of stress is estimated at around 20 billion euros per year and would be for 50 to 60% of the work stoppages. (EASHW, 2014).

In 2012, 9 French out of 10 reported suffering from burnout and 2 out of 10 considered themselves in a State of permanent exhaustion (Piliu, 2012).

If some companies have decided to confront the problem by offering their staff stress management training, this desire is still far from widespread.

Admittedly these things are not always simple.

Sometimes, trade unions oppose the setting up of such training. This would only be a pretext to maintain difficult working conditions. As for ergonomists and occupational psychologists, the answer is first in the modification of working conditions. It is the duty of company managements to make the effort to change, not to employees.

Sometimes, it is the management of companies who refuse to invest in these training sessions for economic and financial reasons. For them, the approach must come from individuals.

It is then in a deadlock situation in which each waits for the other to take the initiative.

When companies implement these training sessions, the topic itself is tricky to treat.

The term "stress" first, is confusing, because it can refer to several different things. This semantic confusion that I noticed during my actions is not always clearly identified and clarified.

On the other hand, it is a kind of complex psychological and physiological phenomena which is difficult to represent in a simple and convincing way.

In addition, it is a living phenomenon which affects the privacy of subjects and it is difficult to present it in a too intellectual manner as those attending training may get bored and reject the approach.

Furthermore, the techniques taught, although proven since long, seem sometimes too simple to be credible. They require a regular practice that is difficult to implement in one or two days of training.

For a dozen years, I participated in designing and facilitating stress management training sessions, first for Air France crisis unit, then for the pilots and now with students of the "Grande Ecole" (Ecole Centrale de Paris, ESSEC, École nationale supérieure Maritime).

I would like to share some of my experience as designer and facilitator.

I would like to insist in particular on five basic points which constitute for me important benchmarks in my practice.

2. Proposal - Development

2.1 Quickly take away the confusion: stress, adaptation or maladjustment syndrome?

The vast majority of stress management training presents the phenomenon as an adaptation syndrome (Seyle, 1950; Rice, 2012): stress would be all physiological and psychological means implemented by a person to adapt to a given event.

To be brief and clear, summarizing the position of the specialists, I would suggest that "stress is a great thing and we must learn to get rid of it."

It is surprising that nobody is surprised. Because if the stress is an adaptation syndrome and allows me to adapt myself to the events of life, how is this a problem? Why get rid of it? Why should one learn techniques that decrease our coping responses?

This may hide an issue that should be clarified.

For scientists in general and in particular physicians, stress is therefore the body's response to deal with anything that could pose a threat in my environment (Rice, 2012).

It is an ancestral reaction. In prehistoric times, man was already equipped with a limbic brain (also called emotional brain) whose role was instantly to trigger behavioral reactions of escaping or fighting whilst facing a threat (the ' Fight or Flight ' of Bradford Cannon, 1929).

The energy required is supplied by the associated emotions: fear and anger.

Human does not escape because he is afraid, he is afraid in order to escape efficiently. When he is afraid, he becomes white with fear. Why? Because the blood leaves the face. And where is it going? In the legs. What for? To run.

When he gets angry, he becomes red with anger. Why? To scare his opponent. Then the blood goes to the hands. What for? Take a weapon, fight.

In parallel quite amazing reactions are implemented. All non necessary flight or fight functions are put on standby: digestion for example stops which explains the feeling of dry mouth (salivation is part of the digestive system). Blood becomes thicker to slow possible hemorrhage, sweating limits heating of the body, the muscles contract to prepare for action. All this without any use of the will. The adaptive response is taking place in an autonomous way. Somehow, human is programmed like this.

And we are all equipped with this wonderful limbic brain that provides two useful things: an alarm signal and the energy to act.

These findings illustrate how stress is a “great thing”.

Moreover, laboratory experiments of Henri Laborit confirmed this: a rat regularly subjected to the threat of a small electric shock and able to respond by flight or fight will develop no pathological accident. It will be in very good state and very healthy unlike the confined rat who cannot escape or fight.

Why should we get rid of stress?

Where is the problem?

Attempting to answer implies to forget the prehistoric humans and return to our time.

If I ask you: do you like to feel full of energy? You will no doubt answer me Yes. If I tell you: do you like to be able to control the situation in which you are involved? You will no doubt answer me Yes.

And if I ask you: do you like to be stressed? You will no doubt answer me No.

Yet we can consider stress as a tension between two energies generally sought by everyone: action energy and control energy.

Let's take an example:

Imagine that you had to speak before 500 people. If you are not used to do so, you will no doubt feel some stress.

Your limbic brain will detect a threat and will trigger the stress response. It will trigger the behavioral sequences flight or fight. If you let it do, you would leave and run or you would give punch to the person who hands you the microphone. This would relieve you no doubt for a few seconds. After the troubles would begin.

So you go contain yourself. And all of this energy that fires your blind will end up blocked, waiting to be used. You will feel an inner tension. Your whole primary body is engaged in a backup action and you resist. Merely to speak does not require such energy. You will feel excess of energy you need to contain.

This tension between two opposing energies (control energy and action energy) that you feel is named “stress”.

When my grandmother was driving, she was behaving in a strange way: she accelerated bottomed permanently and did not regulate her speed with the brake pedal. When she wanted to keep the car going, she left the brake. When she wanted to stop, she operated the brake whilst keeping the accelerator fully pressed.

This behavior may make smile.

However, stressed people behave pretty much as my grandmother: something engages them in pressing the accelerator and they only have the brake available. There is no direct control on the

accelerator. This refers to the concepts of control energy and action energy (Fig. 1) (see also appendix).

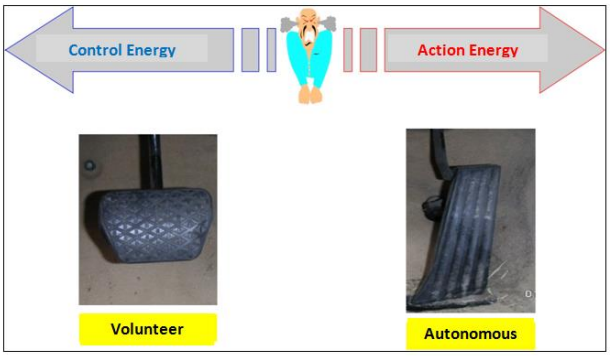

Fig. 1. Illustration of the energies of control and action by analogy with operating a vehicle.

All stress management techniques come back to this: being in contact with the limbic brain telling him: please I do not need all this energy, ease off the pace. Or on the contrary: "I am disheartened, tired, unmotivated, please press slightly the accelerator".

The limbic brain has its language that we must learn to learn to speak. It is the goal of stress management training.

Finally what is stress? An acting energy or a blocked energy? An adaptation syndrome or a syndrome of adaptation sometimes inappropriate?

Probably both. It depends on what you want to designate: the acting energy or the blocked energy that refer to two distinct phenomena.

The important thing is to know what we are talking about. Lots of misunderstanding will be avoided if one takes care to specify.

Some experts believed avoiding the ambiguity in distinguishing "good" stress and "bad" stress as if there could be a good tablet of aspirin and a bad tablet of aspirin. Aspirin is aspirin. It is neither good nor bad. Everything depends on the use that is made. Is it the right dose? Is the drug adapted for the ailments to cure? These are the most relevant questions.

Considering stress as a regulating energy according to the circumstances simplifies the issue: energy is neither good nor bad, it is appropriate to the situation or not.

2.2 Avoiding overly complex models

Wanting to describe accurately and completely an aspect of life such as stress is a challenge. Many training sessions aim to describe the phenomenon as close as possible to the truth. This attempt usually gives enough righteous models, but they are complex and inapplicable outside a scientific context.

Figure 2 shows an example of a complete model.

My purpose is not to question the accuracy of the models, but to question their use in training. These are most often schemas that permit to understand more than to explain.

It is the difference between the world of the researcher and the world of the educator.

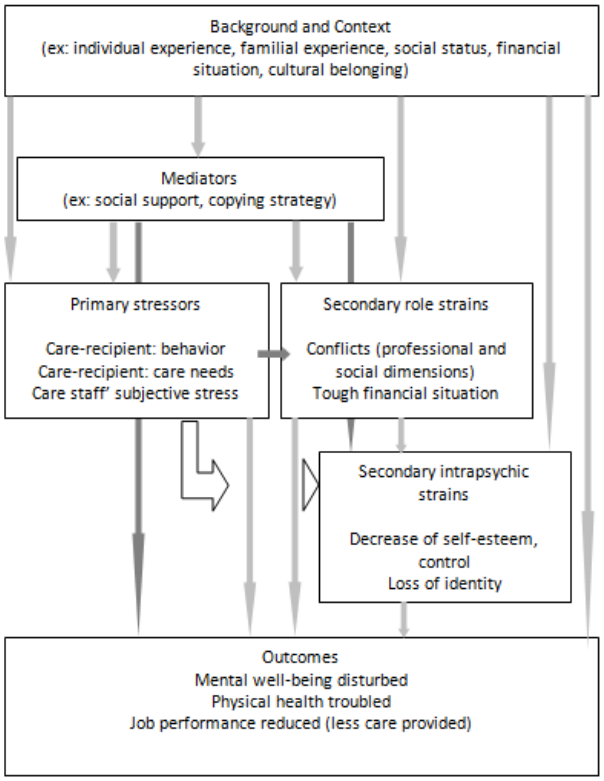

Fig. 2. Example of a model of occupational stress of nurses (adapted from Shah et al. 2010)

The schema of understanding is the culmination of the work of the researcher that evolves step by step into an unknown space. At a given time, this may summarize the understanding reached by the researcher with a model that incorporates all the discoveries. One could compare the researcher with the mountaineer who, once arrived at the top, takes a picture of the landscape and sends it to his friends so that they join.

The schema of explanation is of an entirely different nature. It starts from the reality of the subject and is geared towards an essential element that it intends to seize. You can compare the educator with the mountain guide who, once having reached the summit, goes down back to the plain to start again the ascent guiding others.

It is true that this requires a double work.

2.3 Avoid an overly theoretical approach

Stress is a physiological, limbic, energetic phenomenon. It is not intellectual. First of all it is felt, lived in different ways depending on the person.

Too many training sessions cannot resist the temptation to start with a definition of stress. It's probably a remanence of our years at school. Firstly: definition; Secondly: properties; Thirdly: applications. It is complicated, useless and boring to most of the trainees. It is a teaching bias that can be summed up: "I know the truth, shut up, listen to me and comply your experience to my theory".

A much more useful and interesting approach is to propose something like: "I do not know much, but I propose to travel and discover together...".

Eventually, at a given time, the desire to put words and to define can come in order to sum up a route of understanding. Experience shows that there is no need to know the definition of stress to handle it.

The most commonly used definitions fall into the same trap than models and give accurate formulations but difficult to understand, or give understandable formulations without helping the application of stress management techniques. A few examples:

- "Stress can be defined as the condition that results when person-environment transactions lead the individual to perceive a discrepancy (whether real or not) between the demands of a situation and the biological, psychological or social resources of the individual", Berto, 2014);
- "Psychological stress is a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being", Lazarus & Folkman, 1984: 19);
- "It is a reaction of adaptation of the organism to maintain the balance of the internal state" ("Il s'agit d'une réaction d'adaptation de l'organisme pour maintenir l'équilibre de l'état intérieur", IRS: http://www.gestiondustress.net/index.php?o=13&m=2).

It is precise but indeed disheartening and disconnected from the reality of non-scientific persons. How can these definitions help them?

With the definitions, the more we try to be accurate and the complete and more we go away from an expression easily understandable and usable.

This type of expressions remains relevant for exchange between experts but is rather inappropriate for stress management training in the classroom.

Talking about stress is more efficient from the lived experience than for the theory. Questions to ask are of the type:

- What are the situations that stress you?
- How do you know you're stressed?
- How is this a problem for you?
- What do you do that works well for you?

We must begin little by little from experiences to happen towards a simple and concrete model that corresponds to what is felt and which gives meaning to the techniques you want to propose.

2.4 Making credible the techniques of stress management

Stress management techniques have two drawbacks: they are simple and not spectacular.

They are simple, even too simple to be credible. How to believe that a simple modulation of inhaling and exhaling time can have an effect on my stress?

How to believe that the mere fact of my attention on my own feelings can induce relaxation? How to believe that a simple thought can soothe or stimulate?

In addition, it takes sometimes a little practice time to get a significant effect. It is rare to get a spectacular effect immediately, except maybe for mental imagery techniques.

This is the secret of the effectiveness of stress management techniques: the secret is that there is no secret. It is needed to practice to be effective in a situation.

This is why it is important to introduce these techniques in a convincing way.

One possible approach is to address these techniques by offering a scientific approach:

1. Experiment: testing the effects of a technique without naming it.
2. Observation: ask what has been observed.
3. Principles: deduce one or two major principles.

4. Techniques: explain altogether (trainer and learners) how do these principles apply to a given technique.
5. Application: train to use it.

Practice shows that this approach is convincing. It starts from the lived experience of the subject, what he has observed and what he can understand and then it proposes only a technique the effects of which have already been proven at least partially.

2.5 Staying sincere about the effectiveness of techniques

No stress management technique is almighty. Everything depends on the context of the issue, the personality, the degree of practice and many other parameters.

The techniques are simple, but sometimes difficult to implement in a real situation.

Their credibility goes through repeated practices. The more they are practiced, the more effective they become.

Therefore, it is necessary that those who test their implementation have a priori sufficient confidence in their effectiveness and that they are not discouraged by the first failure occuring. Inevitably, this can happen if the ground is not prepared.

It is better to be sincere on the topic rather than believing in miracles that will not deceive anyone: it takes time to master these techniques.

It may be interesting to propose a follow-up, ideally by individual coaching.

3. Conclusion

For training in stress management techniques to achieve its goals, it is necessary that trainees out of the training room would like to implement what they have learned. For this aim, it is suggested to start from their experiences and to avoid definitions and complex models, and then let them discover for themselves the effectiveness of the proposed techniques.

Of course, it is not conceivable to teach these techniques if the trainers don't practice them themselves daily.

Moreover, it is not education, but sharing: it is essential to remain humble.

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Appendix: Autonomic nervous system

It is interesting to note that the autonomic nervous system consists of two branches: a friendly which "speeds up" most of the functions of the body and a parasympathetic branch "decelerating" most of the functions of the body. The limbic brain controls this "Accelerator/Decelerator".

The scientific community is used to introduce the autonomous system under the model of the accelerator and the brake. The sympathetic nervous system would be the accelerator and the parasympathetic would be the brake. In my opinion this model is not suitable for the problem of stress management and induces many misunderstandings. The model autonomous "Accelerator/Decelerator" (Fig. A1) and voluntary brake (somatic system) seems clearer and more appropriated for stress management techniques training for non-scientific persons.

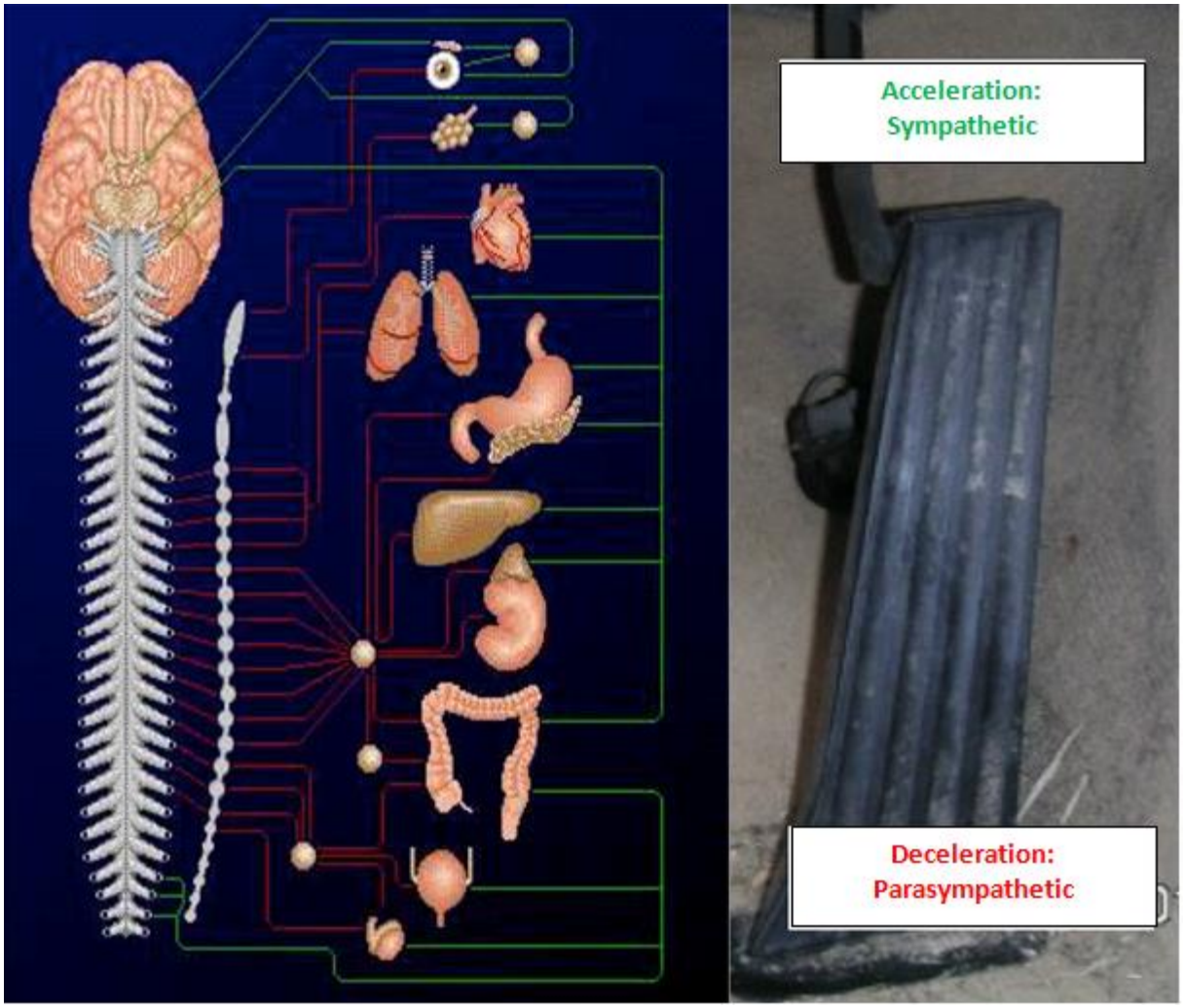

Fig. A1. The "Accelerator/Decelerator" model.
Left: sympathetic and parasympathetic systems.
Right: car analogy.

(Translated from http://img.over-blog.com/450x551/5/23/30/94/systeme-nerveux-autonome.png)

Formations aux techniques de gestion du stress

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Pellissier, P. (2015) Formations aux techniques de gestion du stress, *Stress Self-assessment & questionnaires: choice, application, limits*, 62-68
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Abstract

Il est difficile d'apprendre à nager en lisant un manuel de natation. A un moment ou à un autre, il faut se jeter à l'eau. Et le plus tôt sera le mieux. L'explication théorique viendra après coup, soutenir et éclairer l'expérience. Ou pas. Il en va de même pour la gestion du stress. Enseigner ces techniques est un art difficile. La tentation théorique, la volonté de définir et de contrôler parfaitement un phénomène vivant, la croyance en la toute puissance des méthodes sont autant de pièges à éviter. Le but de cet article est de mettre en évidence les pièges et les secrets pédagogiques d'un enseignement aux techniques de gestion du stress..

Keywords: stress, gestion du stress, formation, coût

1. Introduction

Le stress est un vrai problème de notre temps.

Est-il vraiment nécessaire d'en rappeler le coût humain et économique ?

En France, le Stress au travail coûte plus d'un milliard d'euros par an. Pour l'ensemble des états de l'Union européenne, le coût du stress est estimé à environ 20 milliards d'euros par an et serait à l'origine de 50 à 60 % des arrêts de travail. (EASHW, 2014).

En 2012, 9 Français sur 10 déclaraient souffrir d'épuisement professionnel et 2 sur 10 se considéraient en état d'épuisement permanent (Piliu, 2012).

Si certaines entreprises ont décidé de se confronter au problème en proposant à leur personnel des formations à la gestion du stress, cette volonté est encore loin d'être répandue.

Il faut reconnaître que les choses ne sont pas toujours simples.

Parfois, des organisations syndicales s'opposent à la mise en place de telles formations. Celles-ci ne seraient qu'un prétexte pour maintenir des conditions de travail difficiles. Comme pour les ergonomes et les psychologues du travail, la réponse est d'abord dans la modification des conditions de travail. C'est aux entreprises de faire l'effort de changer, pas aux salariés.

Parfois, c'est le management des entreprises qui refusent d'investir dans ces formations pour des raisons économiques et financières. Pour eux, la démarche doit venir des individus.

On se trouve alors dans une situation de blocage où chacun attend que l'autre prenne l'initiative.

Lorsque les entreprises mettent en place ces formations, le sujet lui-même est délicat à traiter.

Le mot « stress » d'abord, prête à confusion, car il peut désigner plusieurs choses distinctes. Cette confusion sémantique que je repère lors de mes interventions n'est pas toujours clairement identifiée et clarifiée.

Par ailleurs, il s'agit de phénomènes psychologiques et physiologiques complexes qu'il est difficile de représenter de manière simple et convaincante.

De plus, il s'agit d'un phénomène vivant qui touche à l'intimité des sujets et qu'il est délicat de présenter de façon trop intellectuelle, car ceux qui assistent à la formation pourraient s'ennuyer et rejeter l'approche.

En outre, les techniques enseignées, bien qu'ayant fait leurs preuves depuis longtemps, paraissent parfois trop simples pour être crédibles. Elles demandent une pratique soutenue qu'il est difficile de mettre en place en une ou deux journées de formation.

Depuis une douzaine d'années, j'ai participé à la conception et à l'animation de formations à la gestion du stress, d'abord pour la Cellule de Crise puis pour les pilotes d'Air France et maintenant auprès d'élèves des Grandes Écoles (École Centrale de Paris, ESSEC, École nationale Supérieure Maritime).

Je voudrais ici partager quelques points de mon expérience de concepteur et d'animateur.

J'aimerais insister en particulier sur cinq points fondamentaux selon moi et qui constituent pour moi des repères importants dans ma pratique.

2. Proposition - Développement

2.1 Lever rapidement la confusion : le stress, syndrome d'adaptation ou d'inadaptation ?

La grande majorité des formations à la gestion du stress présentent le phénomène comme un syndrome d'adaptation (Seyle, 1950 ; Rice, 2012) : le stress serait l'ensemble des moyens physiologiques et psychologiques mis en œuvre par une personne pour s'adapter à un évènement donné.

Pour être bref et clair, en résumant la position des spécialistes, je proposerais que « le stress est un truc formidable et il faut apprendre à s'en débarrasser ».

Il est étonnant que personne ne s'étonne. Car si le stress est un syndrome d'adaptation et me permet de m'adapter aux évènements de la vie, en quoi est-ce un problème ? Pourquoi s'en débarrasser ? Pourquoi devrait-on apprendre des techniques qui diminuent nos réactions d'adaptation ?

Cela cache peut-être une difficulté qu'il faudrait préciser.

Pour les scientifiques en général et les médecins en particulier, le stress est donc la réponse de l'organisme pour faire face à tout ce qui pourrait constituer une menace dans mon environnement (Rice, 2012).
C'est une réaction ancestrale. Aux temps préhistoriques, l'Homme était déjà équipé d'un cerveau limbique – aussi nommé cerveau émotionnel – dont le rôle était, face à une menace, de déclencher instantanément des réactions comportementales de fuite ou de combat (le « Fight or Flight » de Bradford Cannon, 1929).

L'énergie nécessaire est fournie par les émotions associées : la peur et la colère.

L'Homme ne fuit pas parce qu'il a peur, il a peur pour fuir efficacement. Lorsqu'il a peur, il devient blanc de peur. Pourquoi ? Parce que le sang quitte le visage. Et où va-t-il ? Dans les jambes. Pour quoi faire ? Pour courir.

Lorsqu'il se met en colère, il devient rouge de colère. Pourquoi ? Pour faire peur à son adversaire. Ensuite, le sang se dirige vers les mains. Pour quoi faire ? Prendre une arme, combattre.

En parallèle se mettent en place des réactions tout à fait étonnantes. Toutes les fonctions non nécessaires à la fuite ou au combat sont mises en veille : la digestion par exemple s'arrête ce qui explique la sensation de bouche sèche (la salivation fait partie du système digestif). Le sang devient plus épais pour ralentir une éventuelle hémorragie, la transpiration limite l'échauffement de l'organisme, les muscles se contractent pour nous préparer à l'action. Tout ceci sans le moindre usage de la volonté. La réaction d'adaptation se met en place de façon autonome. En quelque sorte, l'Homme est programmé comme cela.
Et nous sommes tous équipés de ce merveilleux cerveau limbique qui nous fournit deux choses bien utiles : un signal d'alarme et l'énergie pour agir.

Ces constats illustrent que le stress, c'est « un truc formidable ».

D'ailleurs, les expériences d'Henri Laborit en laboratoire le confirment : un rat soumis régulièrement à la menace d'un petit choc électrique et qui peut y répondre par la fuite ou le combat ne fera aucun accident pathologique. Il sera en très bonne forme et très bonne santé contrairement au rat confiné qui ne peut ni fuir ni combattre.

Pourquoi faudrait-il se débarrasser du stress ?
Où est le problème ?

Pour tenter d'y répondre, il faut oublier les hommes préhistoriques et revenir à notre époque.

Si je vous demande : aimez-vous vous sentir plein d'énergie ? Vous allez sans doute me répondre oui.
Si je vous dis : aimez-vous être en mesure de contrôler la situation dans laquelle vous vous trouvez ? Vous allez sans doute me répondre oui.
Et si je vous demande : aimez-vous être stressé ? Vous allez sans doute me répondre non.
Et pourtant on peut considérer le stress comme une tension entre deux énergies généralement recherchées par chacun : une énergie d'action et une énergie de contrôle.

Prenons un exemple :
Imaginez que vous deviez prendre la parole devant 500 personnes. Si vous n'y êtes pas habitué, vous allez sans doute ressentir un certain stress.
Votre cerveau limbique détecte une menace et déclenche la réaction de stress. Il va déclencher les séquences comportementales de fuite ou de combat. Si vous le laissiez faire, vous partiriez en courant ou vous donneriez un coup de poing à la personne qui vous tend le micro. Cela vous soulagerait sans aucun doute pendant quelques secondes. Après les ennuis commenceraient.

Alors, vous allez vous contenir. Et toute cette énergie qui se déclenche à votre insu va se retrouver bloquée, en attente d'être utilisée. Vous allez ressentir une tension intérieure. Tout votre organisme primaire est engagé dans une action de sauvegarde et vous y résistez. Le seul fait de prendre la parole ne nécessite pas une telle énergie. Vous allez vous retrouver en surplus d'énergie que vous devez contenir.
Cette tension entre deux énergies opposées (une énergie de contrôle et une énergie d'action) que vous ressentez est nommée « stress ».

Lorsque ma grand-mère conduisait, elle se comportait d'une façon étrange : elle accélérait à fond en permanence et ne régulait sa vitesse qu'avec la pédale de frein. Quand elle voulait avancer, elle lâchait le frein. Quand elle voulait s'arrêter, elle actionnait le frein, tout en gardant l'accélérateur à fond.
Ce comportement peut faire sourire.
Pourtant, les personnes stressées se comportent à peu près comme ma grand-mère : quelque chose les engage à appuyer sur l'accélérateur et elles n'ont que le frein à disposition. Il n'y a pas de contrôle direct sur l'accélérateur. Ceci renvoie aux notions d'énergies de contrôle et d'énergie d'action (Fig. 1) (voir aussi annexe).

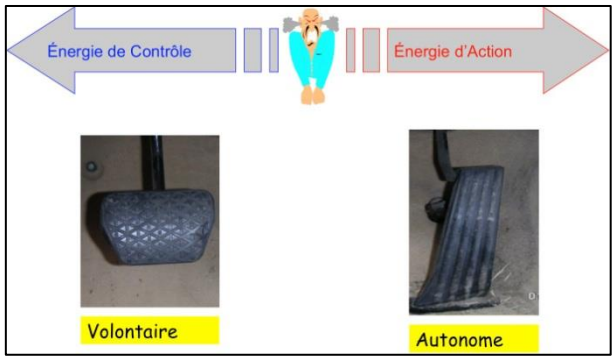

Fig. 1. Illustration des énergies de contrôle et d'action par analogie avec la conduite de véhicule.

Toutes les techniques de gestion du stress reviennent à ceci : communiquer avec le cerveau limbique pour lui dire : « s'il te plait, je n'ai pas besoin de toute cette énergie, lève un peu le pied ». Ou au contraire : « je suis découragé, fatigué, démotivé, s'il te plait, appuie un peu sur l'accélérateur ».

Le cerceau limbique a son langage qu'il faut apprendre à apprendre à parler. C'est le but des formations à la gestion du stress.

Finalement le stress, c'est quoi ? Une énergie pour agir ou une énergie bloquée ? Un syndrome d'adaptation ou un syndrome d'adaptation parfois inadaptée ?

Probablement les deux. Cela dépend ce que l'on veut désigner : l'énergie dégagée ou l'énergie bloquée qui désigne deux phénomènes distincts.

L'important est de savoir de quoi on parle. Beaucoup de malentendus seront levés si l'on prend soin de le préciser.

Certains spécialistes ont cru lever l'ambiguïté en distinguant un « bon » stress d'un « mauvais » stress comme s'il pouvait exister un bon cachet d'aspirine et un mauvais cachet d'aspirine. L'aspirine est l'aspirine. Elle n'est ni bonne ni mauvaise. Tout dépend de l'utilisation que l'on en fait. La dose est-elle la bonne ? Le médicament est-il adapté au mal qu'il veut traiter ? Voilà des questions plus pertinentes.

Considérer le stress comme une énergie à réguler en fonction des circonstances simplifie la question : l'énergie n'est ni bonne ni mauvaise, elle est adaptée ou non à la situation.

2.2 Éviter les modèles trop complexes

Vouloir décrire de façon exacte et complète un aspect du vivant tel que le stress est une gageure. Beaucoup de formations veulent cerner le phénomène au plus près de la vérité. Cette tentative donne généralement des modèles assez justes, mais compliqués et inapplicables hors d'un contexte scientifique.
La Figure 2 présente un exemple de modèle complet.
Mon propos n'est pas de remettre en cause l'exactitude des modèles, mais de questionner leur utilisation en formation. Ce sont le plus souvent des schémas qui permettent de comprendre plus que d'expliquer.
C'est toute la différence entre le monde du chercheur et le monde du pédagogue.
Le schéma de compréhension est l'aboutissement du travail du chercheur qui avance pas à pas dans l'inconnu. À un moment donné, il peut résumer la compréhension à laquelle il est parvenu par un modèle qui reprend toutes ses découvertes. On pourrait comparer le chercheur au montagnard qui, une fois arrivé au sommet, prend une photo du paysage et l'envoie à ses amis afin qu'ils le rejoignent.

Le schéma d'explication est d'une tout autre nature. Il part de la réalité du sujet et est orienté vers un élément essentiel qu'il s'agit de saisir. On peut

comparer le pédagogue au guide de montagne qui, une fois parvenu au sommet, redescend vers la plaine pour recommencer l'ascension en guidant les autres.

Il est vrai que cela demande un double travail.

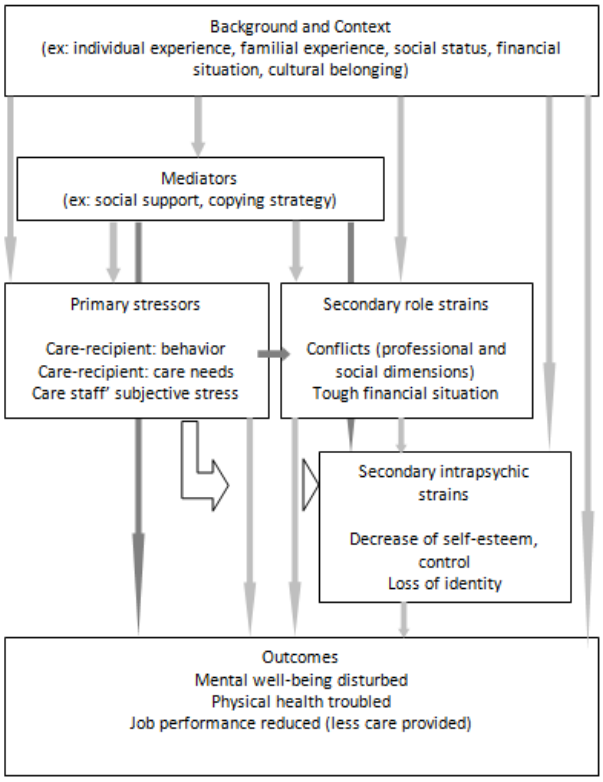

Fig. 2. Exemple de modèle de stress professionnel des aides-soignants (adapté de Shah et al., 2010)

2.3. Éviter une approche trop théorique

Le stress est un phénomène physiologique, limbique, énergétique. Il n'a rien d'intellectuel. Tout d'abord il est ressenti, vécu de manière différente selon la personne.

De trop nombreuses formations ne résistent pas à la tentation de commencer par une définition du stress. Il s'agit sans doute d'une rémanence de nos années d'école. Premièrement : définition ; deuxièmement : propriétés ; troisièmement : applications. C'est compliqué, inutile et ennuyeux pour la plupart des stagiaires. C'est un parti-pris pédagogique qui peut se résumer à : " je connais la vérité, taisez-vous, écoutez-moi et pliez votre expérience à ma théorie ".

Une approche beaucoup plus utile et intéressante consiste à proposer quelque chose comme : " je ne sais pas grand-chose, mais je vous propose de cheminer et de découvrir ensemble…"

Éventuellement, à un moment donné, l'envie de mettre des mots et de définir pourra venir pour résumer un itinéraire de compréhension. L'expérience montre qu'il n'est nul besoin de connaître la définition du stress pour savoir le gérer.

D'autant que les définitions les plus utilisées tombent dans le même piège que les modèles et donnent des formulations précises, mais difficiles à comprendre ou compréhensibles, mais sans pour autant aider à l'application des techniques de gestion du stress. Quelques exemples :

- "Le stress peut être défini comme la condition qui se produit lorsque les transactions-personne-environnement conduisent l'individu à percevoir une divergence (qu'elle soit réelle ou non) entre les exigences d'une situation et les ressources biologiques, psychologiques ou sociales de cet individu" ("stress can be defined as the condition that results when person-environment transactions lead the individual to perceive a discrepancy (whether real or not) between the demands of a situation and the biological, psychological or social resources of the individual", Berto, 2014) ;
- "Le stress est une transaction entre la personne et l'environnement dans laquelle la situation est évaluée par l'individu comme débordant ses ressources et pouvant mettre en danger son bien-être" ("psychological stress is a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being", Lazarus & Folkman, 1984 : 19) ;
- "Il s'agit d'une réaction d'adaptation de l'organisme pour maintenir l'équilibre de l'état intérieur" (IRS : http://www.gestiondustress.net/index.php?o=13&m=2).

C'est précis, mais parfaitement décourageant et déconnecté de la réalité des personnes non scientifiques. En quoi ces définitions peuvent-elles les aider ?

Avec les définitions, plus on essaye d'être précis et complet et plus on s'éloigne d'une expression facilement compréhensible et utilisable.

Ce type d'expressions reste tout à fait pertinent pour échanger entre experts, mais est plutôt inapproprié en salle de formation à la gestion du stress.

Pour parler du stress, il est plus efficace de partir de l'expérience vécue que de la théorie. Les questions à poser en salle sont du type :

- Quelles sont les situations qui vous stressent ?
- Comment savez-vous que vous êtes stressé ?

- En quoi est-ce un problème pour vous ?
- Que faites-vous qui fonctionne bien pour vous ?

Partir du vécu pour arriver, peu à peu, à un modèle simple, concret, qui corresponde à ce qui est ressenti et qui donne du sens aux techniques que l'on veut proposer.

2.4. Rendre crédibles les techniques de gestion du stress

Les techniques de gestion du stress ont deux inconvénients : elles sont simples et peu spectaculaires.

Elles sont simples, voire trop simples, pour être crédibles. Comment croire qu'une simple modulation des temps d'inspiration et d'expiration peut avoir un effet sur mon stress ?

Comment croire que le simple fait de porter mon attention sur ses propres sensations peut induire une détente ? Comment croire qu'une simple pensée peut apaiser ou dynamiser ?

De plus, il faut parfois un peu de temps de pratique pour obtenir un effet notable. Il est rare d'obtenir un effet spectaculaire immédiatement, sauf, peut-être pour les techniques d'imagerie mentale.

Ceci est le secret de l'efficacité des techniques de gestion du stress : le secret est qu'il n'y a pas de secret. Il faut pratiquer pour être efficace en situation.

C'est pourquoi il est important de présenter ces techniques d'une façon convaincante.

L'une des approches possibles est d'aborder ces techniques en proposant une démarche scientifique :

- Expérimentation : tester les effets d'une technique sans la nommer.
- Observation : demander ce qui a été observé.
- Principes : déduire un ou deux grands principes.
- Techniques : expliquer ensemble (formateur et apprenants) comment ces principes s'appliquent pour une technique donnée.
- Application: s'entraîner à l'utiliser.

La pratique montre que cette démarche est convaincante. Elle part de l'expérience vécue du sujet, ce qu'il en a observé et ce qu'il peut en comprendre et propose ensuite seulement une technique dont les effets ont déjà été éprouvés au moins partiellement.

2.5. Rester sincère quant à l'efficacité des techniques

Aucune technique de gestion du stress n'est toute puissante. Tout dépend du contexte, de l'enjeu, de la personnalité, du degré de pratique et de beaucoup d'autres paramètres.

Les techniques sont simples, mais parfois difficiles à mettre en œuvre en situation réelle.

Leur crédibilisation passe par la mise en pratique répétée. Plus elles sont pratiquées, plus elles deviennent efficaces.

Il faut donc que ceux qui testent leur mise en œuvre aient a priori suffisamment confiance en leur efficacité et qu'ils ne se découragent pas au premier échec venu. Ceci arrive immanquablement si le terrain n'est pas préparé.

Il vaut mieux être sincère sur le sujet plutôt que de faire croire à des miracles qui ne tromperont personne : il faut du temps pour maîtriser ces techniques.

Il peut être intéressant de proposer un suivi, idéalement par un coaching individuel.

3. Conclusion

Pour qu'une formation aux techniques de gestion du stress atteigne ses buts, il faut que les stagiaires en sortant de la salle de formation aient envie de mettre en application ce qu'ils ont appris. Pour cela, il est proposer de partir de leur vécu et d'éviter les définitions et les modèles complexes, puis leur faire découvrir par eux-mêmes l'efficacité des techniques proposées.

Bien entendu, il n'est pas imaginable d'enseigner ces techniques si les formateurs ne les pratiquent pas eux-mêmes quotidiennement.

D'ailleurs, il ne s'agit pas d'un enseignement, mais d'un partage : il est essentiel de rester humble.

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Annexe : Système nerveux autonome

Il est intéressant de noter que le système nerveux autonome comporte deux branches : une branche sympathique qui « accélère » la plupart des fonctions de l'organisme et une branche parasympathique qui « décélère » la plupart des fonctions de l'organisme. Le cerveau limbique commande cet « accélérateur/décélérateur ».

La communauté scientifique a l'habitude de présenter le système autonome sous le modèle de l'accélérateur et du frein. Le système sympathique serait l'accélérateur

et le système parasympathique le frein. Ce modèle n'est pas adapté selon moi à la problématique de la gestion du stress et induit de nombreuses incompréhensions. Le modèle « accélérateur/décélérateur » autonome (Fig. A1) et frein volontaire (système somatique) me paraît plus clair et plus adapté à la formation aux techniques de gestion du stress à l'attention de personnes non scientifiques.

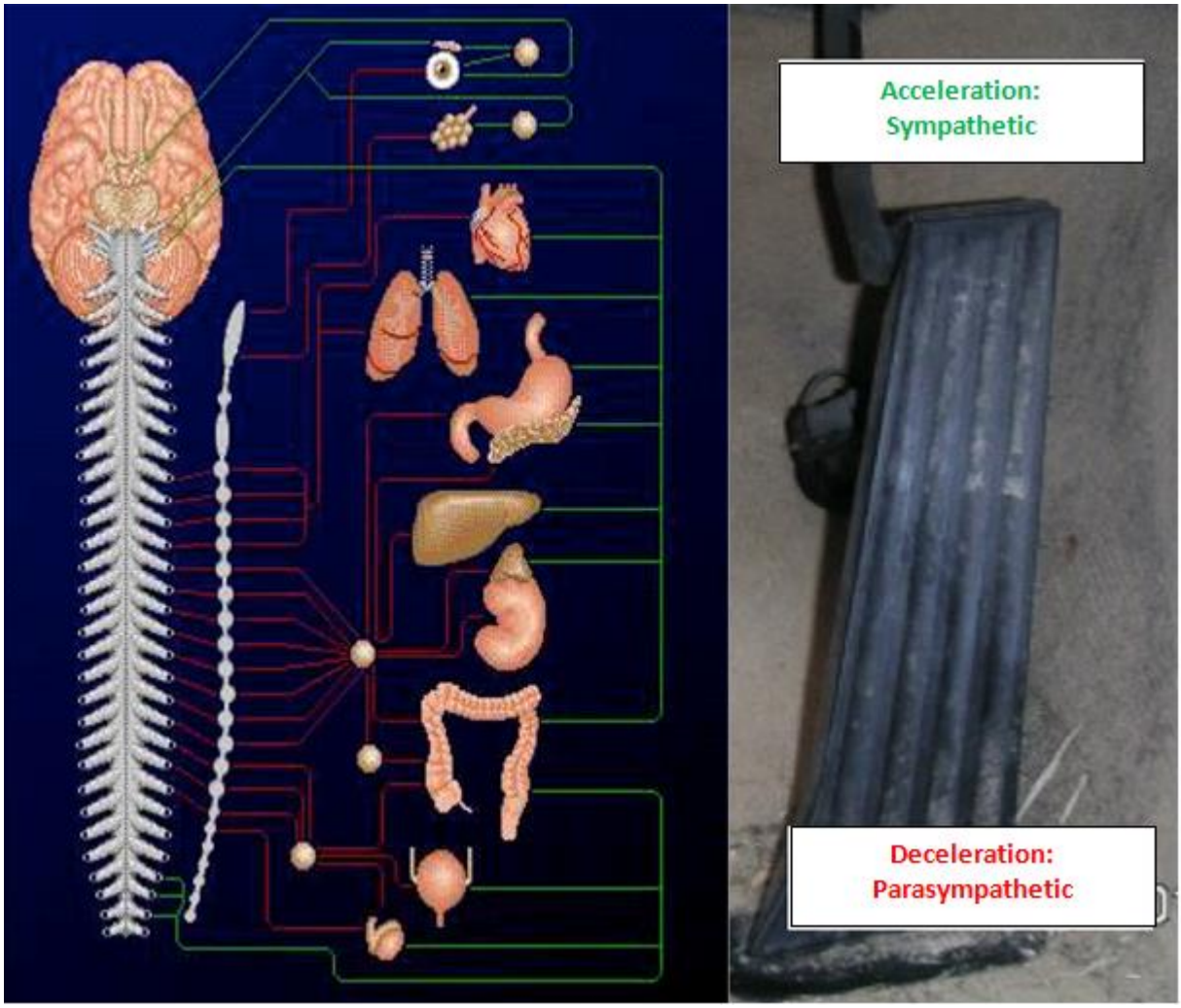

Fig. A1. Le modèle « accélérateur/décélérateur »
À gauche : système sympathique et parasympathique.
À droite : analogie automobile.
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