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Evaluation of a meridian-based intervention: Emotional freedom techniques (EFT) and diaphragmatic breathing for reducing specific phobias of small animals

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This study explored the effectiveness of a meridian-based procedure, Emotional Freedom Techniques (EFT) and a standardized form of Diaphragmatic Breathing (DB) in reducing specific phobias of small animals under laboratory-controlled conditions.

Randomly assigned participants were treated individually for 30 minutes with EFT (n = 18) or the comparison condition, Diaphragmatic Breathing (DB) (n = 17). ANOVAS revealed that both groups improved significantly over baseline but that EFT produced significantly greater improvement than did DB behaviorally and on three self-report measures, but not on pulse rate.

The greater improvement for EFT was maintained, and possibly enhanced, at 6 - 9 months follow-up on the behavioral measure.

These findings suggest that a single treatment session using EFT or DB to reduce specific phobias can produce valid behavioral and subjective effects. Some limitations of the study are also noted and clarifying research suggested.

Interim analysis of a pilot study of a psychoeducational treatment program for comorbid asthma and panic disorder

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The purpose of this study was to evaluate the effectiveness of a psychological treatment program for comorbid asthma and panic disorder. The two disorders have high comorbidity, and a substantial overlap in symptoms, Patients frequently confuse the two problems; but treating the "wrong" problem can be disastrous, sometimes fatal.

The goals of the program were 1) to teach patients to differentiate between asthma and panic symptoms, 2) to assist patients in managing asthma to avoid experiencing unnecessary symptoms, 3) to teach patients skills for managing panic symptoms, and 4) to eliminate symptoms that interfere with daily activity.

Our first protocol, involving 14 weekly sessions, was tried on 10 patients. Assessments were made at Sessions 1,4, 10, 14, and at a one-month follow-up. There was a high dropout rate (n=5) at about Session 8. We therefore instituted an 8-session protocol with assessments at Sessions 1, 4, 8, and two monthly followups, which we have thus far tried on six patients, with no dropouts.

Patients did daily monitoring of symptoms, peak flow, and use of medication.

We taught patients: 1) to differentiate asthma from panic symptoms, 2) proper use of asthma medication, 3) Jacobson's progressive muscle relaxation, 4) slow shallow abdominal breathing, 5) Barlow's panic control method (cognitive restructuring and exposure to feared situations, and 6) assertiveness .

For both protocols, there were apparent improvements in pulmonary function, asthma symptom report, rescue medication usage, and panic symptom report. There were tendencies for improvement in pulmonary function, decrease in Albuterol use, and significant decreases in both asthma and panic symptoms.

**The role of nitric oxide in the pathophysiology of asthma:
Implications for respiratory psychophysiology**

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What we know today about the role of nitric oxide formation both in the pulmonary associated vasculature endothelium as well as in its lung airways produced there by macrophages begs a reexamination of asthma as an inflammatory/autoimmune disease entity. It raises questions about our focus on O₂ and CO₂ as the principal gas variables that we need to address in treatment.

I propose that monitoring expired NO ppb production be a routine part of the determination of the severity of the condition before behavioral psychophysiology treatment, that its progress be monitored during treatment to determine treatment effectiveness, and that it serve as a treatment outcome target criterion.

Evaluation of a Yoga breathing meditation as a treatment for chronic insomnia

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Chronic insomnia has been associated with a physiological hyperarousal of the autonomic nervous system and the hypothalamic pituitary axis. Accordingly, behavioral treatments that are known to reduce arousal such as progressive relaxation and meditation have been shown to be effective treatments.

However, few studies have evaluated yoga and only one study has reported on a breathing technique as an intervention. In a completed preliminary study, and in an ongoing randomized controlled trial (RCT), a yoga breathing meditation treatment has been evaluated as a treatment for insomnia.

Subjects meeting criteria for chronic insomnia completed daily sleep wake diaries and sleep questionnaires on a continuous basis throughout the protocol. Following successful screening, subjects underwent a 2-week pretreatment baseline evaluation, after which 3 overnight ambulatory polysomnograms were conducted (in the RCT only). Subjects were then provided a one-hour training session for the daily 45-minute 8-week yoga intervention (subjects in the RCT were randomized to either yoga treatment or sleep hygiene control treatment and also underwent posttreatment polysomnography). The yoga intervention involved meditation together with maintenance of a slow breathing pattern in which the majority of each breath cycle involved breath retention.

Although results in the RCT are currently under analysis, the preliminary study of 20 subjects revealed statistically significant reductions in multiple subjective sleep parameters derived from sleep diaries and insomnia questionnaires. A subset of subjects also showed reductions in 24-hour urinary assays of cortisol and catecholamines.

Similar improvements are expected in the RCT, and would suggest that this yoga breathing meditation would be a useful adjunct to existing behavioral treatments for insomnia. Furthermore, it might also suggest that regulation of breathing, sometimes recommended as a treatment by sleep specialists, may be specifically useful in the treatment of insomnia.

Heart rate variability biofeedback as a treatment for fibromyalgia

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The purpose of this study was to assess the effectiveness of heart rate variability biofeedback, as a treatment for the symptoms of Fibromyalgia Syndrome (FMS) and to provide an adjunctive treatment to standard drug therapy for individuals suffering from Fibromyalgia.

Fibromyalgia is characterized by high baseline of sympathetic arousal, decreased parasympathetic activity, and diminished heart rate variability, reflective of dysregulation of the ANS, which results in disruption of homeostatic balance and a blunted stress response. The autonomic dysfunction may underlie pathophysiology seen in FMS and produce the symptom chronicity seen in FMS patients (e.g. pain, stiffness, and fatigue).

We examined the efficacy of a 10-session Heart Rate Variability (HRV) biofeedback intervention for the reduction of FMS symptoms. Patients received 10 sessions of biofeedback training to increase heart rate variability at each individual's resonant frequency.

We found clinically and statistically significant improvement in the Fibromyalgia Impact Questionnaire ($p < .02$), the Beck Depression Inventory ($p < .02$), the Pittsburgh Sleep Quality Index ($p < .004$), and the McGill Pain Questionnaire ($p < .03$).

Four of the 12 female fibromyalgia patients (ages 18-65) were considered non-responders and even reported increased pain, eight were considered responders reporting at least a 25% improvement in pain, and six reported at least a 50% improvement in pain. Pain improvement was not contingent upon improvement in sleep or depression.

Surprising data from a pilot study of Breathing and Motion Behaviors on Respiratory, Cardiovascular and Autonomic Nervous System Behaviors in the Healthy Elderly

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Contrary to information in textbooks e.g. Guyton (1976) about the functionality of Respiratory Sinus Arrhythmia (RSA) in elderly, we observe both normal, some times perfect, qualitatively (pattern) and quantitatively (amplitude) behaviors/patterns in healthy elderly.

Furthermore, during specific maneuvers we observe increase in both respects in those subjects.

According to consensus opinion about relations between heart rate variability, RSA and Cardioagal Tonus and its relation to health this indicate that frequent training of those maneuvers even might predict increase in health behavior per se.

Preliminary data indicate that this also is the case. Implications for primary care application will be discussed.

Heart Rate Variability Biofeedback In Patients With Recurrent Abdominal Pain: A Multiple Case History Study

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The hypothesis that Recurrent Abdominal Pain (RAP) has been hypothesized to be associated with a deficit in autonomic nervous system recovery to stress and an enhanced behavioral and subjective response to pain. (Feuerstein, Barr, Francoeur, Houle, & Rafman, 1982). Most currently empirically validated treatments make use of this hypothesis to some extent. This study investigates the efficacy of a treatment protocol for RAP that focuses on autonomic balance.

Patients diagnosed with RAP were referred for Heart Rate Variability Biofeedback treatment by a pediatric gastroenterologist at Kaiser Permanente in San Diego. The subjects were seen by one of three interns that had completed a course on Biofeedback and Psychophysiological disorders and attended weekly supervision meetings with a licensed psychologist (the second author).

Autonomic regulation measures were collected in the form of peak-valley differences of Respiratory Sinus Arrhythmia (RSA) (for breaths within the .15 to .4 range). Pain severity was assessed by a VAS scale completed by the participants before and after treatment (Naliboff, Fullerton, & Mayer, 1999). RAP symptom frequency was measured by the number of episodes per week pre and post treatment. Two patients were monitored with ambulatory monitoring equipment (VivoMetrics LifeShirt).

Of forty-three patients referred to Biofeedback, thirty-six were treated. (age range of 7 to 18 years). A paired t-test analysis revealed a significant difference in pre and post self-report ratings of pain intensity ($t(8)=4.494, p<.001, \eta^2=0.49$) and frequency ($t(14)=4.498, p=.002, \eta^2=0.38$). Pre and post peak-valley differences of respiratory sinus arrhythmia (RSA) at a paced breathing rate were also analyzed with a paired t-test and found to be significant ($t(6)=-3.20, p=.019, \eta^2=0.36$).

Follow-up data collected on 16 patients from a range of a one month to 2 years after treatment. Follow pain intensity and frequency were both significant compared to pre measures ($t=3.810, p=.019; t=3.627, p=.007$, respectively).

Fifty-six percent of contacted patients were pain-free at follow-up interview. Ambulatory data will be presented.

In conclusion, subjects with RAP were able to significantly lower their ratings of pain intensity and frequency within an average of six sessions of HRV Biofeedback administered by interns in a pediatric medical setting.

Paced-breathing as a multi-facial therapeutic intervention: review of mechanisms and integrative View concerning neural, cardiovascular and pulmonary effect

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Slow and deep abdominal breathing has been traditionally considered as a technique for eliciting the "relaxation response" to which health benefits were attributed. In fact, slow and effortless breathing modulates beneficially neural, pulmonary and cardiovascular (CV) systems.

The larger changes in lung volume that occur during slow breathing activate mechanically pulmonary and cardiac receptors. The resulting phasic neural activity sensitizes reflexes that control heart rate and blood pressure. This increases heart rate variability that diminishes in CV disease and under stress and anxiety.

An important outcome of paced breathing is the inhibition of sympathetic outflow during exhalation, leading to a reduction of peripheral resistance to blood flow. This acute response to paced breathing may develop into a sustained benefit when paced-breathing is exercised routinely at the home setting.

Efficacy of such treatment has been demonstrated in hypertension and congestive heart failure with paced breathing interactively guided by a device. Clinical outcomes depend on patient's compliance and exercise performance, where both can be monitored automatically. Effortless performance of the exercise plays an important role in achieving long-term compliance.

We may conclude that the therapeutic power of paced-breathing has some physiological rationale.

The Experimental Study on the Effects of Pause Breathing Patterns on Heart Rate Variability

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In order to observe the effect of Pause Breathing (PB) patterns on Autonomic Nervous and determine the Yin and Yang modulating mechanism of PB, two different PB patterns: Inhaling-Exhaling-Pause (I-E-P), Inhaling-Pause-Exhaling (I-P-E) with two different respiratory frequencies: 16 breaths/min and 5 breaths/min were observed on 10 healthy adults.

We used R-R interval spectral analysis of Heart Rate Variability (HRV) to determine the Parasympathetic Nervous System (PNS) and Sympathetic Nervous System (SNS) activities.

We found (1) I-E-P and I-P-E at 16 breaths/min didn't exert significant influence on autonomic nervous systems, (2).

Both I-E-P and I-P-E at 5 breaths/min increased sympathetic activity, on basis of which, I-E-P which could enhance exhaling, also increased parasympathetic activity, and I-P-E which could enhanced inhaling, induced more increased sympathetic activity.

From the view of Chinese Medical theory, the former breathing had the action of strengthening Yang, while the latter reducing Heat and enhancing Yin. (3) There were physiological after-effects after the respiratory regulation.

Yoga for adolescents with health concerns

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The literature documenting beneficial effects from yoga practices with adults with medical illness is growing. A meta-analysis of the literature concluded that the evidence is promising, but not yet conclusive that yoga techniques are effective in reducing symptoms of illness. However, a number of studies consistently demonstrate decreases in concomitant anxiety and depression for adults with stress exacerbated chronic illnesses. There is a dearth of studies looking at these same interventions with children and adolescents.

This study was undertaken to examine the feasibility of implementing yoga as a complementary intervention for adolescents with stress-related medical and mental health disorders.

The intervention consisted of 102 one-hour yoga classes taught over a period of nine months. The free classes were offered three days per week at The Children's Hospital, Denver. Each class included physical postures, breathing exercises, and guided relaxation.

Thirty-six adolescents consented to participate. The subjects were 81% female, 85% Caucasian, and an average of 15.3 years-old (range 13.1 to 19.7). The subjects presented with a variety of medical and psychiatric diagnoses.

Eight subjects completed the baseline measures, attended at least one yoga class, and completed the follow-up measures within one month of attending a yoga class.

The parent's ratings on the BASC showed significant improvement from time 1 to 2 on the depression, anxiety, internalizing, behavior symptoms, and adaptive behavior subscales.

On the teen self-ratings, there was a significant relationship between the number of classes attended and clinical improvement, with subjects who attended more classes showing significantly greater improvement on the BASC somatization, depression, emotional symptoms, and clinical maladjustment subscales. There was significant improvement on the MASC harm avoidance subscale.

The teens rated themselves as significantly less distressed by their top three concerns.

The principle obstacle to participation was transportation. A shorter, more intensive intervention is recommended to increase adherence.

Hyperventilation in patients with Chronic Fatigue Syndrome : The role of coping strategies

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Hyperventilation has been suggested as a concomitant of Chronic Fatigue Syndrome (CFS) that may contribute to the symptom pattern, and as a possible maintaining factor of the disease.

Because patients accepting the disease and trying to live with it seem to have a better prognosis than patients chronically fighting it, we investigated breathing behavior during different coping response sets towards the disease in patients with CFS (N=30, CDC criteria).

Patients imagined a relaxation script (baseline), a script describing a coping response of active defence and nonacceptance, and a script depicting response of acceptance of the disease and its (future) consequences.

Finally, patients were instructed to mentally prepare for a demanding bicycle ergometer test, as part of the standard diagnostical protocol.

During each imagery trial and during anticipation of physical exercise, end-tidal PCO₂ (Microcap® Handheld Capnograph, Oridion) was measured, as well as heart rate and breathing behavior (time and volume parameters, using respiratory inductive plethysmography, LifeShirt, Vivometrics).

After each trial, patients filled out a symptom checklist.

Results showed low resting values of PetCO₂ overall, while only imagery of hostile resistance triggered a decrease and deficient recovery of PetCO₂.

Also more hyperventilation complaints and complaints of other origin were reported during hostile resistance imagery compared to acceptance and relaxation.

Hostile resistance seems to trigger both physiological and symptom perception processes, contributing to the clinical picture of CFS.

Yoga breathing Therapy in COPD: An exchange of East and West techniques

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Vijai Sharma, PhD, Cleveland, TN, USA

Donna Frownfelter, PT, RRT, Rosalind Franklin University of Medicine and Science, Chicago, IL, USA

Larry Cahalin, PT, Northeastern University, Boston, MA, USA

Breathing training is an integral part of Yoga, and anecdotes suggest Yoga may be of benefit in COPD. Several current studies are exploring the benefits of Yoga for COPD. This workshop centers about Yoga techniques specifically designed for COPD by Dr. Vijai Sharma, a practicing Clinical Psychologist, who has created an instructional video for patient self use by people with COPD. This project is supported by the National Emphysema / COPD Association (NECA), as part of their mission of empowering people with COPD.

Over the past several months members of this workshop have been involved in evaluating and refining this video, and attempting to understand and reconcile these Yoga techniques with traditional western chest physiotherapy techniques and related physiology. These evaluations have attempted to identify relative strengths in both eastern and western techniques into overall “best practices.”

Physiologic constraints and rehabilitation therapy objectives will be defined by Clinical Pulmonologist Dr. Deane Hillsman. He will also discuss the respiratory psychophysiology viewpoint, and insights into physiological and psychological benefits of slow / deep breathing. The Yoga perspective will be given by Dr. Vijai Sharma. Dr. Sharma is a Practicing Clinical Psychologist, in final training to be a certified instructor in Viniyoga. The chest physiotherapy perspective will be given by Donna Frownfelter and Larry Cahalin. Donna Frownfelter is an academic Physical Therapist, Board certified in Cardiovascular and Pulmonary Physiotherapy, and a Registered Respiratory Therapist. She is an assistant professor at Rosalind Franklin University of Medicine and Science, and co-author of “Principals and Practice of Cardiopulmonary Physical Therapy” which will soon issue it’s fourth edition. Larry Cahalin is an academic Physiotherapist, from Northeastern University, with a special interest in cardiopulmonary physiotherapy. He is co-editor of “Cardiovascular and Pulmonary Physical Therapy: An Evidence-Based Approach.”

The first half of the workshop will be theory presentations to define problems and objectives, followed by “hands-on” demonstrations and audience participation of beginning and intermediate COPD / Yoga techniques by two teams comprised of an expert Yoga and Chest Physiotherapist.

The last half of the workshop will mainly be demonstrations by the two teams of advanced COPD / Yoga techniques. This will be followed by Chest Physiotherapy commentary and general summary comments. A long interactive session is planned, and it is hoped the audience will bring their questions and clinical technique skills before the workshop to enhance the knowledge of all.

Clinical Application of Respiratory Inductive Plethysmography: Ambulatory Monitoring and Sleep

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Respiratory Inductive Plethysmography measures thoracoabdominal movements (TAM) and quantifies lung volume change in terms of TAM. TAM are regular during breathing, with irregular TAM (artifacts) occurring during body movements and posture change. During steady state exercise in the laboratory, it is possible to control for body movements, and respiratory responses to exercise may be quantified. Extension of TAM pattern analysis is now possible and permits recognition of respiratory responses in ambulatory subjects.

Characteristic TAM patterns in the upright posture in normal subjects reflect the diaphragm's 'prime mover' status, while thoracic and abdominal volume displacements are relatively passive. Changes in TAM patterns can be identified that correspond to active thoracic and abdominal muscle contraction.

In subjects with lung disease, thoracic movements increase in amplitude relative to those of the abdomen, with both active and passive thoracic motion.

Coughing may be easily detected from TAM patterns, and is emerging as a viable outcome variable of treatment intervention in patients with lung disease.

During sleep, TAM patterns in the supine posture favor abdominal volume displacements, driven passively by the diaphragm in normal subjects, but in patients with lung disease, there is often a marked increase in thoracic movements with evidence of active thoracic muscle contraction. TAM patterns may show asynchrony between thorax and abdomen in lung disease, and during REM sleep in normal subjects.

TAM asynchrony is emerging as a viable outcome variable both to stage sleep, and for treatment interventions in patients with lung disease.

Whole body breathing: Assessing and managing dysfunctional breathing patterns.

Jan van Dixhoorn, MD, Amersfoort, The Netherlands

From a system's perspective respiration plays a dual role in the organism. On the one hand it responds adequately to the system's requirements and sustains both mental and physical activities. Thus, changes in breathing reflect to large degree changes in physical and/or mental demands made upon it.

A criterion of functional breathing therefore, is its flexibility: the capacity to respond to variation in system requirements.

On the other hand, respiration is a vital function, which is open to conscious control and regulation. Thus, the subject may voluntarily change one's breathing pattern, in order to influence his mental or physical state.

It is difficult to describe dysfunctional breathing patterns per se, because a specific pattern may look dysfunctional but actually be the result of a specific mental or physical determinant. The respiratory pattern may simply reflect that and we should respect that.

In this workshop we will explore variation in the distribution of respiratory movement. We will practice a method for graphic representation and manual assessment in the sitting position of different breathing patterns. Its utility in treatment will be shown.

We will differentiate the role of posture and mental focus as determinants of breathing. It will appear that slow, diaphragmatic breathing is not always functional. Also, upper thoracic breathing can be done both in a functional and a dysfunctional way.

A Respiratory Self-Control Method Based on Psychophysiological Studies

Akio Umezawa, Ph.D.

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This paper describes a training method for self-control of breathing based on our previous studies on psychological stress, emotions, and basic experimentation clarifying psychophysiological effects of self-control of breathing.

Our early studies on effects of stress upon respiratory function (Umezawa, 1991) revealed that respiratory parameters showing sensitive and constant changes during various stressors were minute ventilation (MV) and post-exhalation pause time (PT): MV increased and PT decreased significantly during stressors. Recently we also found that minute ventilation significantly increased not only during film clips eliciting negative emotions but also during ones eliciting positive emotions. These data suggested that respiratory system showed a non-specific facilitation during stress and emotions.

We have recently studied on self-control of respiration, because self-control of breathing is the most frequently used strategy to calm down in the daily stressful situations in Japan (Umezawa, 1996). Among respiratory parameters, MV and partial pressure of end tidal PCO₂ (PetCO₂) can reflect total state of ventilation. We therefore conducted experiments in which subjects were asked to control their MV or PetCO₂ (Terai, Takeuchi, & Umezawa, 2004; Terai & Umezawa, 2004).

The results in these experiments were as follows: (1) subjects succeeded in decreasing their PetCO₂ significantly from baseline-rest, whereas they could not increase their PetCO₂ above rest-level. (2) There were a few subjects who could not be prevented from increasing in MV during stressor, whereas subjects who were able to prevent increases in their MV in response to the stressor showed smaller stressor-induced increases in their heart rate ($p < 0.08$). (3) It was not easy for novice subjects to increase PetCO₂ from baseline-rest or to prevent MV increases during stress. For an alternative training method, ten subjects underwent progressive slow-paced respiration tasks. Subjects were asked to slow their breathing gradually to a controlled rate of 12, 10, 8, 6, 4, and 2 breaths/min and to estimate. All subjects succeeded in adjusting their breathing to the prescribed rates.

For two subjects, however, PetCO₂ levels dropped markedly below baseline levels (Terai, et al, 2004).

Numerous studies have focused on slow and deep diaphragmatic breathing for facilitating relaxation. However, we have little known about why diaphragmatic is more effective than rib-cage dominant (thoracic) breathing. Therefore we tried to compare abdominal-dominant breathing with rib-cage dominant one.

Data obtained from the experiment showed that Rib cage dominant breathing increased MV

significantly ($p < .05$), whereas abdominal breathing did not increase MV. This result suggested that abdominal breathing is a suitable respiration pattern to prevent from hyperventilation during paced-respiration training. To check this hypothesis, two subjects who showed decreases in PetCO₂ during progressive paced-respiration task, participated in an additional session in which they were asked to do progressive slow abdominal breathing. As a result, their PetCO₂ were maintained at the resting level.

In summary, slow paced abdominal breathing is the effective method to prevent from increases in MV and decreases in PetCO₂.

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Behavioral, Neural, and Genetic Concomitants of Respiratory Modulated Heart Rate Variability

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In recent years the number of publications employing measures of respiratory modulated heart rate variability (HRV) has grown exponentially. However, to date, little systematic investigation of the genetic, neural, and behavioral concomitants of HRV has been undertaken.

This presentation will provide an overview of the work from our laboratory examining the many aspects of HRV. We have investigated the genetics of HRV using both molecular and behavioral genetic techniques.

In one study we found that HRV was related to the angiotensin-converting enzyme insertion/deletion gene (ACE I/D). There was evidence of a positive dose-response relationship between the presence of the I allele and higher levels of HRV. The DD variant has been associated with increased risk of myocardial infarction and was associated with the lowest levels of HRV in our study.

In a second study using behavioral genetic techniques we found that females had greater HRV than males as indexed by RSA and by ApEn (an index of complexity). This was independent of respiration rate, heart period, physical activity, smoking, body mass index, waist circumference, anti-hypertensive use, and in females, menopausal status and contraceptive use. Heritability estimates were approximately 35% and did not differ between males and females.

We examined the neural control of HRV using both pharmacological blockade and neuroimaging studies. In one study of 83 patients we pharmacologically blocked either the left or right hemisphere of the brain. Blockade of either hemisphere produced a decrease of HRV but this effect was larger with right hemisphere blockade.

These data are consistent with the known neural innervation of the sino-atrial node suggesting larger chronotropic influence of the right sided neural inputs.

In another study, using positron emission tomography (PET), we found that activity in the prefrontal cortex was correlated with HRV. Again this effect was somewhat larger on the right side.

In two other series of studies we have examined the association of resting HRV levels with cognitive and affective regulation. In the first series we have shown that HRV is positively associated with performance of executive function tasks such as working memory. In another series of studies we have shown that resting levels of HRV are related to emotion regulation as indexed by the startle reflex and the cardiac defense response. Higher levels of resting HRV were associated with smaller startle magnitude, more differentiated emotion modulated startle responses, and more rapid habituation of the cardiac defense response.

Importantly, in all of the studies reviewed here we found evidence of a gender difference such that females had greater vagal modulation than males. These studies have helped to explicate the complex role that respiratory modulated HRV plays in our daily lives. Further understanding of HRV will enhance its usefulness in both clinical and experimental settings.

Applications of HRV: Using the Concept of "Vagal Withdrawal" in Clinical Assessment.

Richard Gevirtz, Ph.D., Alliant University, San Diego, CA, USA

Historically, many stress related disorders were conceptualized as being driven by overactive sympathetic mechanisms and or HPA over-activation. More recently, the role of the Parasympathetic Vagal systems have been postulated to be more involved in causing or maintaining symptoms.

In this presentation, I will demonstrate how psychophysiological data recordings, either on line or ambulatory, can be used to create etiological and treatment models that make sense to clients both biologically and psychologically.

Vagal withdrawal is seen as the first response to threat or worry, one that can persist for long periods of time and eventually create physical and/or psychologically symptoms.

Frequency ranges of the respiratory and heart rate baroreflex systems are in close agreement

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The goal of this presentation is to show how breathing effects on cardiovascular functions depend on respiration rate. Eight healthy individuals (5 males and 3 females) participated in the study. Subjects breathed for 5 minutes at each of 9 frequencies (0.5, 0.25, 0.143, 0.11, 0.077, 0.055, 0.04, 0.029, and 0.02 Hz). An instantaneous tidal volume curve (from a strain gauge) and a sine-wave pacer were presented on a computer screen. Each subject was instructed to follow the pacer precisely with his (her) tidal volume curve.

Paced breathing caused HR and BP sinusoidal oscillations at these frequencies. The amplitude and phase transfer Functions (TF) between respiration as the input and HR and BP as output, were computed separately for each assigned frequency. Baroreflex gain was computed as transfer function between BP as the input and HR as the output.

The TF shows the accuracy of following the pacer. The amplitude TF shows that subjects breathed at precisely the same amplitude at all frequencies. The phase TF shows that respiration preceded the pacer at low frequencies.

Also, there is a frequency range (0.02–0.2 Hz) where respiration has the strongest effects on HR. In this range the phase TF changes from positive to negative, and crosses "0" at a frequency close to 0.1 Hz. In the amplitude TF, the peak frequency occurs where the phase TF is 0. The amplitude TF has a peak frequency where the Phase TF is 0. A positive phase means that HR precedes respiration.

Breathing in the frequency range (0.02-0.2 Hz) causes considerable sinusoidal oscillations in BP. In this range the Phase TF changes from positive to negative, and crosses "0" at a frequency close to 0.03 Hz. The amplitude TF has a peak at frequency where the Phase TF is 0. A positive phase means that BP oscillations precede respiration.

Baroreflex gain is calculated as TF between BP (input) and HR (output). In the frequency range (0.02-0.2 Hz) baroreflex gain becomes minimal when close to 0.03 Hz, and further increases when the frequency increases.

HR and BP oscillations are in phase only at a frequency close to 0.03 Hz.

Greater mental stress-induced reductions in cardiac parasympathetic activity predict coronary and aortic atherosclerosis in healthy postmenopausal women

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Reduced cardiac parasympathetic activity, as indexed by reduced high-frequency heart rate variability (HF-HRV), relates to a greater risk for atherosclerosis among patients with coronary artery disease (CAD).

The present study tested whether reduced resting or mental-stress induced cardiac parasympathetic activity also relates to preclinical coronary or aortic atherosclerosis among individuals without CAD.

Spectral estimates of 0.14-0.40 Hz HF-HRV were obtained from 98 postmenopausal women (aged 61-69 yrs) who engaged in a 3-minute speech-preparation stressor after a 6-minute resting baseline. A mean of 266 days after HF-HRV assessment, the extent of coronary and aortic calcification, noninvasive markers of preclinical atherosclerosis, were determined using electron computed tomography (ECT).

Binary logistic regression analyses showed that larger reductions in HF-HRV from baseline to speech preparation predicted greater calcification in the coronary arteries (ECT scores > 10, B = -.89, $p < .01$) and in the aorta (ECT scores > 144, B = -1.20, $p = .009$).

Further, larger speech-stressor induced reductions HF-HRV continued to predict both coronary and aortic calcification after multivariate adjustment for these potential confounders: age, smoking status, body mass index, resting systolic blood pressure, fasting glucose and high density lipoprotein concentrations, respiration rate, and baseline HF-HRV.

In contrast to these findings, univariate or multivariate analyses showed that baseline HF-HRV did not relate to coronary or aortic calcification. Among individuals without CAD, greater mental-stress induced reductions in HF-HRV independently predict greater coronary and aortic calcification.

These results parallel and extend prior work in CAD patients showing that reduced cardiac parasympathetic activity relates to a greater risk for atherosclerosis.

Six Established Reasons Why Respiratory Sinus Arrhythmia Is NOT Cardiac Vagal Tone but May Sometimes Reflect It.

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Respiratory sinus arrhythmia (RSA, or high-frequency heart-rate variability) is frequently employed as an index of cardiac vagal tone or even believed to be a direct measure of vagal tone.

Ease of RSA assessment by means of commercially available analysis programs has led to wholesale employment of the measure by researchers uninformed about the many significant caveats regarding vagal tone interpretation, among which are the following:

Respiratory parameters of rate and volume can confound relations between RSA and cardiac vagal tone. Although within-subject relations between RSA and cardiac vagal control are often strong (when properly measured), between-subject associations may be relatively weak.

RSA measurement is profoundly influenced by concurrent levels of momentary physical activity and can bias estimation of individual differences in vagal tone.

RSA amplitude is affected by beta-adrenergic tone.

RSA and cardiac vagal tone can dissociate under certain circumstances. A currently popular, evolution-based theory (among psychologists) about RSA and vagal tone is inaccurate: its fundamental assumptions are in error, and it ignores the phenomenon of cardiac aliasing and the probable biological function of RSA to enhance cardiopulmonary efficiency.

Disregard or lack of knowledge of these issues can lead to grave misinterpretation and misattribution of cardiovascular autonomic mechanisms.

On the other hand, RSA has been shown to provide a reasonable reflection of cardiac vagal tone when research proceeds in an informed and careful manner.

Heart Rate and Blood Pressure Oscillations: Windows on Human Neurophysiology

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Respiratory activity continuously alters membrane potentials of preganglionic vagal and sympathetic motoneurons and thereby modulates their responsiveness to stimulatory inputs. The most apparent manifestation of such 'respiratory gating' is respiratory sinus arrhythmia: the rhythmic fluctuations of electrocardiographic R-R intervals observed in healthy resting humans.

Phasic autonomic motoneuron firing depends importantly on the intensity of stimulatory inputs, such that when levels of stimulation are low (as with low arterial pressure and vagal activity, or high arterial pressure and sympathetic activity), respiratory fluctuations of vagal or sympathetic firing are also low.

The respiratory gate has a finite capacity; high levels of stimulation can override the ability of respiration to gate autonomic responsiveness.

Autonomic throughput also depends importantly on other properties, including especially, the frequency of breathing, the rate at which the gate opens and closes, and the kinetics of effector responses to released acetylcholine or norepinephrine.

Respiratory sinus arrhythmia is small at rapid, and large at slow breathing rates. The strong correlation between systolic pressure and R-R intervals at respiratory frequencies reflects the influence of respiration on these two measures, rather than arterial baroreflex physiology.

A wide range of evidence suggests that respiratory activity gates the timing of autonomic motoneuron firing, but does not influence its tonic level.

It may be that the most enduring significance of respiratory gating is its use as a precisely-controllable experimental tool to tease out and better understand otherwise inaccessible human autonomic neurophysiological mechanisms.

Stress, anxiety, and cortisol in adolescents with asthma

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Twin, epidemiologic and clinical studies have demonstrated a small but consistent association of atopic disorders with anxiety and depression, primarily due to shared genetic inputs. An altered hypothalamic-pituitary response to stress is one potential biologic system affecting both atopic and internalizing disorders. Prior studies have shown that adolescents with atopic disorders have lower cortisol responses to stressors than non-atopic controls. This study examines whether the attenuated cortisol response to a public speaking task can be explained by higher anxiety and/or depression.

Sixty one asthmatic and non-asthmatic adolescents participated in the Trier Social Stress Test (TSST).collected 6 saliva samples at home that were analyzed for cortisol Subjects completed the Multidimensional Anxiety Scale for Children, Reynolds Adolescent Depression Scale, and the Posttraumatic Stress Reaction Index. A "High Risk" variable was defined as being >1 standard deviation above the mean on any of these measures having a t-score > 60 on any of these instruments. Two subjects were excluded because their cortisol levels were over 3 S.D. above the sample means.

Home cortisol patterns did not differ with respect to asthma status, steroid medications or psychiatric measures. Cortisol response to the TSST did not relate to steroid medications. A Manova analysis with repeated measures of cortisol over time during the TSST showed significant main effects for asthma status ($p < .05$) and significant effects for time ($p < .01$); and significant interactions for time by asthma ($p < .01$), time by high risk ($p < .05$), and time by asthma by high risk ($p < .05$). Non-asthmatics had an overall higher cortisol level than asthmatics. While non-asthmatics with high internalizing symptoms had a low baseline followed by a high cortisol response to the TSST, however, asthmatics with high internalizing symptoms had entirely the opposite pattern, with an initial high cortisol that decreased over the stressor.

This study replicated prior studies in finding that adolescents with asthma had a lower cortisol response to the TSST than non-asthmatics. High internalizing symptoms do not explain the attenuated cortisol response in asthmatics. However, the attenuated response to psychological stressors may be more important in children with asthma who have higher internalizing symptoms, and may be exposed to more perceived psychological stressors, thus explaining their increased risk of asthma exacerbations.

Asthma, Attitude, Adherence

Andrea J. Apter, M.D., M.Sc.

Adherence to health care provider's advice is poor in many chronic diseases, including asthma. Although inhaled corticosteroids (ICS) are safe and efficacious medications for asthma, nonadherence contributes to asthma morbidity.

There are many barriers to taking chronic medications like ICSs including their cost, the inconvenience of taking them, and the intermittent occurrence of symptoms. We focused on factors modifiable through patient-physician interactions.

In one study of 50 mostly urban minority adults with moderate or severe asthma, we found that lower adherence was associated with less satisfaction with the patient physician relationship.

In a subsequent prospective cohort study of 85 adults with moderate or severe persistent asthma in which medications were provided, low adherence was associated with patients' concern of perceived risks, which outweighed the perceived benefits of ICS. We called this assessment by the patient of the "Attitude."

In a subsequent qualitative study we explored Attitude toward ICSs in a group of African American asthmatic adults. These patients expressed a reliance on their assessment of asthma control over that of the health provider as well as fears of addiction, weight gain, and cancer. Participants emphasized that adherence was only one of a myriad of problems patients solve daily.

In another qualitative pilot study using a problem-solving approach to improving adherence, we found that problems with adherence and patients' solutions were highly individualized and integrated with other everyday problems.

Patients' health care providers must explore patients' attitudes and attempt to understand how asthma is integrated into patients' lives.

Neural Mediation of Stress on Airway Function in Asthma

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The Autonomic (ANS) Dysregulation Model of the Influence of Emotions in Asthma (Miller, 1987; Miller and Wood, 1997) proposes, and our findings to date support, that depression is associated with emotional and physiological (ANS) dysregulation which potentiates vagally mediated airway constriction, giving rise to a destabilized asthmatic state. A key hypothesis is that the emotion dysregulation of depression plus acute stress will evoke an imbalance in the autonomic nervous system, and that this imbalance will potentiate airway compromise in children with asthma.

The movie E.T., the Extra-Terrestrial was used to provide emotion-specific challenges to 148 adolescents with asthma, ages 11-16, while continuously measuring autonomic nervous system (ANS) modulation of the cardio-respiratory system and airway function. Continuous measures of PEP and RSA taken at baseline and throughout the movie index sympathetic and parasympathetic activation, respectively.

Scenes evoking fear, sadness/hopelessness, happiness/excitement and mixed sadness/happiness were compared to each other and to a neutral scene and baseline.

Initial inspection of the data from 48 subjects reveals patterns of temporal relationship between the measures of PEP and RSA suggestive of ANS dysregulation during stressful scenes in some subjects.

These preliminary findings support the feasibility of using this methodologic approach to investigate the association between ANS dysregulation and depression, disease activity and airway function in children with asthma.

Emotions and Child Asthma: Effects of Family Relations

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The Biobehavioral Family Model (BBFM) posits that family patterns of relational process evoke psychophysiological processes that influence disease activity in children (Wood, 1993, Wood et al 2000). The revised BBFM incorporates parent-child relational security as a pivotal construct.

The current study applies the BBFM to asthma by testing a model which integrates the BBFM with Miller's (1987) Autonomic Nervous System (ANS) Dysregulation Model of Emotions and Asthma. The integrated model posits that negative family emotional climate contributes to child depression, which in turn contributes to asthma disease activity. Parent-child relational security was tested as mediating and/or moderating the effect of family climate on child emotions and disease activity.

Children with asthma (N=112), along with their parents, completed the Family Expressiveness Questionnaire, the Relatedness (child-parent) Questionnaire, and the Child Depression Inventory. The child's Disease Activity was rated using guidelines from the National Heart, Lung and Blood Institute's 2002 criteria for mild intermittent, mild persistent, moderate persistent and severe persistent asthma.

Path analytic techniques revealed support for the overall model and the proposed pathways of effect and indicated a mediating role for parent-child relational security in the impact of family climate on child depression and disease activity.

These findings indicate that negative family emotional climate and relational insecurity contribute to child depression and asthma disease activity.

Asthma and First Onset of Major Depressive Disorder in a Community Sample

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Asthma has been associated with a number of mental disorders, including anxiety and affective disorders. We study the relationship of having a diagnosis of asthma to predict the first onset of major depressive disorder among 1,634 at-risk individuals over 15 years follow-up, using the Baltimore Epidemiologic Catchment Area cohort.

Participants were interviewed with the Diagnostic Interview Schedule to obtain DSM diagnoses and also were interviewed about their medical history. All those with a history of major depressive disorder at baseline were excluded from the analyses. Logistic regression analyses were conducted adjusting for sociodemographic and medical variables, with major depressive disorder as the outcome variable. Also, we included a second model adjusting for the above variables and also minor depression.

Individuals with a history of asthma were not likely to have a first lifetime episode of major depressive disorder (Odds Ratio = 1.01, 95% Confidence Interval: 0.41, 2.49). Likewise in the model including minor depression, similar results were obtained (Odds Ratio = 0.75, 95% Confidence Interval: 0.30, 1.87).

Asthma is not associated with the first onset of major depressive disorder over a 15 year follow-up. Our results may differ from other studies in the medical literature because we have a longer follow-up period. Also, our design of excluding those with a prior history of major depressive disorder may inadvertently exclude those who have a major depressive episode as part of coping with their asthma.

Emotional triggers in asthma: Of movies, cultures, labs and cats

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Emotions and stress have been discussed as potential asthma triggers for some time. However, the relative importance of individual trigger categories, including psychological triggers, varies considerably across larger clinical and epidemiological studies.

Variations in methodology may make studies susceptible to lay theories to a different extent. As an example for the pervasiveness of lay theories, we analyzed mainstream entertainment movies that included scenes of asthma exacerbation: While classical asthma triggers such as allergens and physical activity are rarely portrayed, the overwhelming majority of movie scenes showed asthma symptoms triggered by emotions and stress.

To assess patients' perceived asthma triggers in a psychometrically valid fashion, we have developed the Asthma Trigger Inventory, a self-report questionnaire measure that includes a psychological trigger subscale. Across trigger subscales, British, American and German patient samples showed relatively good agreement, with approximately 15-25 % of the sample reporting a role for psychological triggers. The psychological trigger subscale proved to be an important predictor of general health status and oral corticosteroid use.

In experimental studies using emotion induction techniques, we typically observed mild bronchoconstrictions during negative emotional states, and sometimes also during positive states. Airway response to laboratory emotion induction covaried with reports of emotion-induced asthma and with lung function impairment during negative mood episodes in the field.

Currently, evidence for vagal or ventilatory pathways of emotion-induced airway responses are sketchy.

Preliminary findings from a study with blood and injury stimuli suggests that even stronger emotional arousal with vasovagal responses to these stimuli does not constrict the airways dramatically.

Finally, naturally occurring asthma in animals such as cats has rarely been studied. An analysis of cat owners' reports suggests that emotions and stress are also perceived among the main asthma triggers in this species.

More research is necessary to elucidate situational elicitors and physiological pathways of emotion-induced bronchoconstriction.

Panic Anxiety and Vocal Cord Dysfunction in Pulmonary Medicine

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Panic Disorder (PD) and Vocal Cord Dysfunction (VCD) are two common syndromes frequently seen in pulmonary practice.

This presentation will review relevant literature supporting the thesis that both PD and VCD are part of a family of CNS disorders of respiratory control that arise due to induced, "central sensitization" of CNS areas involved in monitoring and protecting the airways and the process of respiration.

In this "sensitized" state, various CNS reflexes that evolved to protect the airways in contexts of acute respiratory danger, such as cough, mucous secretion, panic anxiety, and vocal cord closure, are triggered at lower thresholds leading to these reflexes firing in inappropriate and dysfunctional situations.

The inappropriate and dysfunctional firing of these hyperactive reflexes, at least in part, contribute to a vicious cycle that keeps the specific CNS respiratory control areas in a "sensitized" state, hence the chronic nature of these conditions.

Does hyperventilation cause panic?

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In a recent article by Roth, Wilhelm, and Pettit (*Psychological Bulletin*, in press) we examine six theories of panic from the standpoint of Popper's falsifiability criteria.

We argue that a simple hyperventilation theory of panic postulating that a drop in pCO₂ causes panic is falsifiable, and that it has indeed been falsified.

Ronald Ley developed a more complex theory of three types of panic attacks: Type I is caused by episodes of hyperventilation, Type II is a learned response to stimuli associated with one or more previous Type I attacks, and Type III is triggered by cognitions.

We will discuss this more complex theory from the standpoint of falsifiability and evidence.

A problem for Type I attacks is knowing whether hyperventilation was a cause or effect of anxiety.

A problem for Type II attacks is being certain that a Type I attack occurred in the past.

A problem for Type III attacks is establishing the causal potency of specific cognitions independently from whether an attack followed them.

In general, a causal typological theory must be able to assign causes to specific individuals without knowledge of their presumed effect.

Hyperventilation in response to environmental chemical exposures

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A significant proportion of Gulf War veterans (GWV) report chemical sensitivity, fatigue, and unexplained symptoms resulting in ongoing disability. Gulf War veterans frequently recall an association between diesel and petrochemical fume exposure and symptoms during service. The purpose of the present study among Gulf War veterans was to evaluate the immediate health effects of acute exposure to chemicals (diesel vapors with acetaldehyde) with and without stress.

In a single, controlled exposure to 5 parts per million (ppm) diesel vapors, symptoms, odor ratings, neurobehavioral performance, and psychophysiologic responses of 12 ill GWV veterans (GWV-I) were compared to 19 age and gender matched healthy GWV (GWV-H).

Relative to baseline and to GWV-H, GWV-I reported significantly increased symptoms such as disorientation and dizziness and displayed significantly reduced end-tidal CO₂ just after the onset of exposure. As exposure increased over time, GWV-I relative to GWV-H reported significantly increased symptoms of respiratory discomfort and general malaise. GWV-I were also physiologically hyporeactive in response to behavioral tasks administered during but not before exposure.

Current symptoms among GWV-I may be exacerbated by ongoing environmental chemical exposures reminiscent of the Gulf War. Both psychologic and physiologic mechanisms contribute to current symptomatic responses of GWV-I.

**Air hunger in response to hypercapnia in the Modified Rebreathing Test :
Effects of repetition and anxiety.**

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Hypercapnia produces an uncomfortable urge to breathe, termed "air hunger". As a subjective response, it may also be influenced by several variables such as anxiety, fatigue, repeated experiences, etc..

In this study we investigated how the latter variables shaped the intensity of air hunger during gradually increasing levels of CO₂.

Normal high and low (trait) anxious participants (N=23) went through three subsequent trials with the Modified Rebreathing Test while rating air hunger every 12 sec with a mouse click on a computerized 1-100 Visual Analogue Scale. Also time and volume parameters (Fleisch pneumotachograph) and FetCO₂ (Poet II) were measured.

Each trial started with a hyperventilation phase until FetCO₂ reached 3.3% and was followed by a rebreathing phase in a 5-liter bag, filled with 95 % O₂, until either FetCO₂ reached 7.9% or the air hunger rating reached 100.

After each trial participants rated the maximal intensity of the state anxiety and fatigue they had felt during the trial. Each trial was separated by a 15 min pause.

Conscious Control of Breathing

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Breathing in anesthetized animals and in deep sleep in animals and humans is complexly but automatically controlled via chemo and mechanoreceptor reflexes, which drive networks of neurons and perhaps pacemaker neurons located mainly in the rostroventral medulla.

Arousal from sleep and breathing in the awake state depend upon the interplay of factors originating from voluntary actions and behavioral factors with these reflex mechanisms. This interplay adds to the versatility of breathing and increases the ability of normal gas exchange to be maintained in the face of adverse environmental conditions and diseases of the lung and thorax. The interaction of these two forms of control (conscious and behavioral) is seen constantly in the awake state in states of anxiety, emotional conflict, problem solving and even when activities such as exercise are imagined.

In addition to older physiologic methods and psychological techniques, newer methods such as fMRI, PET scanning and dipole tracking have provided data on the anatomy of the higher brain centers involved in conscious control and their interaction with the behavioral system.

In certain rather rare syndromes only one of the two systems is operating. In the **locked-in syndrome** caused by bilateral infarction of pontine blood vessels only automatic control remains. The patient is quadriplegic and there is little if any control of the cranial nerves. However normal responses to carbon dioxide and oxygen inhalation remain and gas exchange can be satisfactory. In the syndrome of **congenital central hypoventilation**, which is associated with certain genetic abnormalities and Hirschsprung's disease, both the ventilatory responses to hypoxia and hypercapnia may be absent. It's interesting that in this condition conscious control is sufficient to maintain normal levels of gas exchange during the awake state at rest and even during moderate exercise.

The conscious control of breathing and its ability to exert a quite fine control of breathing is assisted by the ability of humans to sense if they concentrate breathing movements (tidal volume and minute ventilation for example) with a high degree of accuracy. Normal humans can sense mechanical impediments to breathing such as those that occur with lung disease such as asthma. Awake humans but not sleeping humans when forced to breathe through some device that impedes lung and chest wall movements quickly increase the force of contraction of their respiratory muscles so as to maintain normal levels of ventilation.

Sometimes breathing becomes noticeable even when no special attention is paid to it and dyspnea is said to occur. Dyspnea may become an incapacitating symptom that is largely untreatable. It is now recognized to be made up of two different uncomfortable sensations: air hunger and an increased effort in breathing. The first is due to inadequate gas exchange and the second to an increase in the muscular effort required to breathe. Together they lead to an increase in dyspnea at less than or greater than usual levels and this may help regulate breathing levels.

Dyspnea can be an important distress signal and may be inadequately developed in patients with near fatal asthma.

While in most instances automatic and the conscious control of breathing act cooperatively, inappropriate activity of either regulating system may occur because of enhanced chemosensitivity or breathing awareness and may underlie such problems as chronic hyperventilation and panic disorder.

Psychiatric disease and symptom report among high risk inner-city patients

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The purpose of this study was to assess the association between psychiatric disease and asthma morbidity among patients attending an ethnically diverse, inner-city asthma clinic for an initial visit.

A semi-structured psychological interview was conducted to assess for psychiatric disease. A pulmonary physician, who was blind to psychiatric disease, established diagnosis of asthma based on national guidelines.

Sixty-four percent of 86 participants received at least one psychiatric diagnosis. No differences emerged between patients with and without psychiatric disease on percent predicted FEV1 and asthma medications that patients were taking.

Patients with a psychiatric disorder reported a higher severity level for asthma symptoms than the severity level indicated by their pulmonary function.

In contrast, psychiatrically healthy patients demonstrated close concordance between symptom level and pulmonary function ($p = .017$).

The pulmonary physician rated patients with a psychiatric disorder as achieving fewer goals ($M = 1.3 \pm 1.3$) for asthma control than patients without a psychiatric disorder ($M = 2.6 \pm 1.5$, $p = .0001$). Patients with a psychiatric disorder more frequently reported an emergency room visit for asthma during the past six months ($OR = 5.6$, 95% CI, 2.0 - 15.3) and greater use of short-acting 2-agonist medication ($M = 1.5 \pm 0.9$ canisters per month) than psychiatrically healthy patients ($M = 0.9 \pm 0.8$, $p = .004$). These findings were independent of demographics and asthma severity.

Psychiatric disease is associated with greater perceived impairment from asthma, increased emergency health care utilization, and poorer self-care for asthma.

Symptom Perception in the Family Context.

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Poorly controlled asthma is critical problem in pediatrics. Individual factors (e.g., symptom perception) and the family approach to asthma management may influence outcomes. The present study assessed the direct and indirect contributions of symptom perception and family management to pediatric asthma morbidity.

One hundred ten children with asthma (47% female, ages 7-17) and their caretakers participated. Symptom perception was assessed over five weeks using a programmable electronic spirometer that prompted children to guess their PEFr prior to objective measurement.

Peak flow blows were classified into zones of accuracy (AZ), danger (DZ), or symptom magnification (SMZ) by use of an error grid (Klein et al., 2004).

A semi-structured interview (FAMSS; Klinnert et al., 1997) was conducted to assess family asthma management. Asthma morbidity was assessed by questionnaire. Analyses controlled for severity.

Results demonstrated that the proportion of blows in each of the grid zones was linked to morbidity (AZ $R^2 = 10\%$; DZ $R^2 = 4\%$, SMZ $R^2 = 5\%$, all p 's $< .05$).

Family asthma management was also associated with morbidity, ($R^2 = 19\%$, $p < .001$). Regression analyses indicated that family asthma management mediated the association between dangerous symptom perception (i.e. proportion of DZ blows) and morbidity. Accurate symptom perception and symptom magnification remained associated with morbidity when family asthma management was taken into account.

Individual and family factors influence pediatric asthma morbidity.

The relationship between symptom perception and family strategies may be most relevant when children underestimate the symptom severity.

Symptom Perception in Children with Asthma: Cognitive and Psychosocial factors

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This study examined associations among cognitive-based factors, psychosocial processes, and the perceptual accuracy of asthma symptoms in children.

Cognitive-based factors included an estimate of children's intelligence (i.e., WISC) and aspects of attention such as cognitive flexibility (i.e., Trails), visual attention (i.e., Cancellation tasks), and short and long term attention (i.e., CPT, WISC arithmetic and digit span; Connors behavior parent report).

Psychosocial factors included children's depressive symptoms (i.e., CDI) and anxiety (MASC).

The Asthma Risk Grid, a clinical tool used to compare patients' subjective estimates of symptoms with objective lung function data, was used in order to obtain a clinical interpretation of symptom perception. Multiple subjective (peak flow guess)/objective (actual PEFr) assessment points are summarized in a ratio to illustrate a pattern of perceptual ability. Resulting points fall into an accurate (subjective assessment corresponding appropriately to objective clinical status), danger (points falling in clinically significant compromised function) or symptom magnification zone (points reflecting oversensitivity to minor symptoms)

Participating families are from African American (21%), Latino (6%), Anglo (65%), Biracial (7%), and Indian/Native American (1%) backgrounds (N= 282). Children are between the ages of 7 and 17. A range of severity levels is represented. Results of analyses using Structural Equation Modeling reveal that the model including standardized scores assessing accuracy (errors) and speed (time) from the Cancellation and Trails tasks best fit the data to explain differential outcomes in Grid Zone scores.

Children's visual scanning, planning, cognitive flexibility and to some degree, fine motor skills, strongly predicted their perceptual accuracy and overestimation of asthma symptoms.

When children are highly attuned to changes in respiratory functioning, they may accurately perceive their asthma symptoms. Difficulties maintaining attention is associated with a tendency to over-exaggerate the severity of symptoms.

Cortical representation of dyspnea: clinical findings and perspectives

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Dyspnea is an unpleasant sensation of difficulty breathing and a symptom in respiratory and other pathologic conditions. The adequate perception of the severity of bronchial obstruction has emerged as a key factor for the prevention of severe asthma attacks, specifically in current self-management-programs.

Incorrect perception of dyspnea has been observed across asthmatic patient populations and found to be associated with both under- and overmedication and also with (near-) fatal asthma attacks.

Several underlying mechanisms were examined in previous work, but predominantly at the peripheral level of the target organ. Recent studies applying respiratory-related evoked potentials (RREP) have found reduced P1 and P3 components in asthmatic children and adults, indicating deficits in the neuronal information processing related to breathlessness.

However, little is known about cortical areas involved in the perception of dyspnea from functional imaging studies. Most of the research so far applied positron emission tomography (PET), and only one used high resolution functional magnetic resonance imaging (fMRI). Asthmatic patients have not been included in these imaging studies.

Across most studies activation in specific limbic, paralimbic, and cerebellar structures were observed. Among these, the insula seems to play an important role in processing information regarding breathlessness.

These cortical areas have also been shown activated in functional imaging of pain processing, which has been examined in much greater detail in recent years. Because of further similarities between these unpleasant sensations, dyspnea and pain, it has been suggested to adopt findings and methods from pain research for investigations into dyspnea.

We presented an overview about current findings of imaging studies on dyspnea. Furthermore, possible trends for future research on breathlessness with regard to pain perception were discussed.

Dyspnoea and ventilatory mechanics during progressive exercise in COPD and Patients with Idiopathic Hyperventilation.

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Patients with COPD commonly experience dynamic hyperinflation (DH) when ventilatory drive is increased. DH is associated with dyspnoea and reduced quality of life in COPD.

Subjects with idiopathic hyperventilation (IH) also report a reduced exercise tolerance and poor health status. These subjects have been shown to breathe thoracically at rest and have sustained hypocapnia during exercise.

We wanted to establish if subjects with IH have DH despite normal lung function and to assess the ability of LifeShirt (LS) to identify the presence of DH in differing populations. Also to evaluate the relationship between DH and breathlessness as measured by a modified Borg score during progressive cycle ergometry in patients with moderate to severe COPD and patients with IH.

We collected respiratory variables with a non-invasive ambulatory monitoring system, the LifeShirt (LS), and simultaneously measurements with a Cardio2 metabolic cart (C2). 10 patients with moderate to severe COPD, 8 patients with IH and 10 controls (% predicted FEV1 43.6(17); 87.6 (5) 94.8(10)% respectively; mean(SD).

All subjects performed a progressive cycle ergometry exercise test to symptom limitation; inspiratory capacity (IC) and Borg score ratings were measured at rest and at 2 minute intervals. Hypocapnia was present and sustained in the IH group PETCO₂ (mmHg) at rest and end exercise was 27.5(4.6) and 33.3(6.3) respectively.

LS identified 8 COPD patients and 5 IH patients with DH based on a pattern of changes in %rib cage contribution to tidal volume (%RC) and cumulative change in end expiratory lung volume (qdEELV), with confirmatory data of a concomitant decrease in inspiratory capacity in all DH subjects.

None of the control subjects displayed DH with either system. In the 8 COPD with DH, Borg score increased 4.5 points median (range 2-9) from baseline to end exercise.

The change in Borg score in the IH group with DH was 6.5 (range 4-8). The 2 IH subjects demonstrating the most DH normalised their PETCO₂ at maximal exercise with a concomitant fall in VE prior to the final minute of work. The change in Borg score was not correlated with the change in indicators of DH in either group. It is therefore possible that other disease

characteristics such as duration of disease, physical fitness, or severity may confound the relationship between changes in Borg score and ventilatory mechanics.

Identification of DH in chronic respiratory disease patients outside of the laboratory may enable substantial improvement in disease understanding and treatment.

The Asthma Symptom Profile: Additional reliability and validity analyses of a psychophysical scale for rating intensity and unpleasantness of asthma symptoms

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The Asthma Symptom Profile (ASP) is a psychophysical scale designed to allow patients to use magnitude estimation procedures to rate their subjective experience of three dimensions of asthma symptoms: intensity, unpleasantness, and quality. Patients rate each symptom descriptor by designating a number and drawing a line that represents that adjective's relationship to a standard adjective for its subscale.

In this study, 77 participants completed the ASP at the orientation session and at session 9 of a study of a biofeedback treatment for asthma. On average, nearly 3 months elapsed between administrations ($M=84.05$ days, $SD = 24.94$).

Test-retest reliability was analyzed across subjects for each descriptor individually, and within subjects for each participant on all descriptors, using numbers only ("number"), lines only ("line"), both line and number as separate data pairs ("overall"), and means of line and number values ("mean").

Across subjects, test-retest correlations were generally low to moderate (Number: $M= .307 \pm .20$; Line: $M= .471 \pm .14$; Overall: $.439 \pm .18$; Mean: $.466 \pm .18$). Within subjects, test-retest correlations were quite high (Number: Mdn: $.891$, IQR: $.08$; Line: Mdn: $.900$, IQR: $.10$; Overall: Mdn: $.879$, IQR: $.08$; Mean: Mdn: $.915$, IQR: $.07$).

The relatively low correlations for individual adjectives may be due to low variability in the way participants rated the adjectives, particularly with respect to the number task, in which participants tended to assign multiples of 5 to all adjectives; and also due to a possible floor effect in that there was much less room for variation at the lower end than at the higher end of the scale.

In addition, because participants had been medically stabilized before beginning the study, they reported relatively few symptoms throughout the study; this may have affected ratings due to either low salience or high habituation to specific symptoms.

Nevertheless, for particular individuals, symptom ratings remained relatively stable over time, particularly when the two composite measures (overall and mean) were used.

Further study is recommended to see whether stability over time varies according to asthma severity or demographic factors.

Evaluation of breath holding time and lung function before and after an intensive yoga program.

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Background:

The practice of yoga breathing techniques is thought to improve the efficiency and stability of breathing and improve breath-holding time (BHT). While shortened BHT has been observed to accompany breathing disturbances, protocols for measuring this have not been standardized.

Russian physician, Dr. Buteyko developed a method for measuring BHT and proposed that increased BHT indicates an improvement in breathing efficiency and general health. The Buteyko breathing technique which is based on this premise has since been promoted as a treatment for asthma and has been shown to improve asthmatic symptoms without changing lung function.

The current study aimed to assess BHT and lung function in a group of advanced yoga practitioners and in non-practitioners before and after an intensive yoga program.

Methods:

Spirometry and BHT measures were performed on a group of 10 males aged between 40-60 attending an intensive residential yoga program in Bangalore, India and a group of long-term (20-40 year) yoga practitioners who were also interviewed about their practice and respiratory health. BHT was recorded according to the Buteyko method and to physiological breaking point as indicated by involuntary diaphragmatic motion.

Results:

BHT using both techniques increased substantially in 80% of participants after the yoga intensive, approaching the levels found in long-term yoga practitioners. Only slight improvements were seen in lung function although one case showed dramatic improvement.

Two long-term yoga practitioners that previously had asthma and believed themselves cured were observed to have moderate to severe airway obstruction on spirometry.

Discussion:

Improvements in BHT after yoga practice may indicate a training effect and alteration in chemoreflex related to relaxation and reduced minute ventilation rather than improved lung function.

The evidence of airway obstruction without subjective symptoms in long term yoga practitioners was a startling finding although in keeping with what has been observed by others.

A Pilot Study of Heart Rate Variability(HRV) Biofeedback in the treatment of Major Depressive Disorder(MDD)

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Autonomic nervous system (ANS) dysfunction is thought to play an important role in depression. Although other forms of biofeedback have been proven effective in the treatment of depression, HRV biofeedback is unique in its capacity to treat ANS dysfunction.

HRV Biofeedback is a standardized treatment that is simple with specific targeted effectiveness to physiological changes. It can be learned easily by most individuals. HRV biofeedback training involves slowing the breathing rate to the frequency ("resonant frequency") at which, in each individual, amplitude of HRV is maximized.

Although for most people, RSA amplitude is maximized when breathing at the rate of 6 breaths per minute (.1Hz.), the exact resonant frequency varies among individuals. When people try to maximize their HRV they inevitably breathe at their resonant frequency thereby making this the easiest way to increase HRV.

This, in turn, should directly produce more effective blood pressure modulation and indirectly, through the anatomical projections from the baroreceptors to the hypothalamus and limbic system, should increase modulation of emotionally and autonomically-mediated reflexes throughout the body.

Our preliminary data already suggest that HRV biofeedback is an effective treatment for depression. Pilot data collected from an on-going, uncontrolled 10-week HRV Biofeedback treatment for MDD (n=5) reveals a trend towards a decrease in overall depression severity from data collected at baseline, sessions 4, 7, and 10.

Inclusion criteria consisted of a primary diagnosis of MDD as assessed by the Structured Clinical Interview for DSM-IV (SCID). Clinically significant improvements by Session 10 were noted on the Hamilton Depression Scale (HAM-D) for many study participants. Three out of the four participants who have completed the 10-session protocol to date, have evidenced at least a 50% improvement from baseline while the third participant exhibited a 46% improvement.

This on-going project is demonstrating feasibility given that four out of five participants have already completed and one more participant is expected to complete shortly. Questionnaires consisted of interviewer-rated and self-rated measures of depression and anxiety, of health status, quality of life and mood states. Physiological measures consisted of EKG, EMG, thoracic and abdominal breathing (respiration rates) and finger temperature. Data collected at the first session was repeated at the fourth, seventh, and tenth sessions.

This work will expand the field of HRV biofeedback by exploring this non-pharmacological adjunctive treatment in patients with MDD.

Prevalence and Correlates of Asthma in Clinically Anxious Children

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Recent studies on adults from clinical and community settings suggest an association between asthma and a range of mental disorders, particularly anxiety disorders. In youth, anxiety disorders among asthmatics are significantly higher than in non-asthmatic peers or youths with other chronic medical illnesses. To date, relatively little is known about the prevalence of children with asthma seeking mental health treatment in clinical settings.

To further investigate the link between childhood anxiety and asthma, we assessed the prevalence rates of asthma in a sample of 376 children and adolescents (age 4-18) seeking psychological treatment for anxiety through the Center for Anxiety and Related Disorders (CARD) at Boston University between 1998 and 2004.

Results indicated that 16% of child and adolescent patients with an Axis I disorder also had an additional diagnosis of asthma, which was three times higher than the ones found in the general child and adolescent asthma population in the US. While generalized anxiety disorder (GAD) ranked highest amongst child and adolescent asthmatics (17%), panic disorder with or without agoraphobia was the most prevalent diagnosis among non-asthmatics (11%). The diagnosis of GAD was nearly twice as high amongst those with asthma, as compared to non-asthmatics (9.8%).

Significant differences were also found between anxious children with asthma and without asthma on child and parent self-report measures:

On the Multidimensional Anxiety Scale for Children, asthmatic children attained significantly higher total scores as well as higher scores on the physical symptoms subscale than children without asthma.

On the Child Anxiety Sensitivity Index, asthmatic children reported higher total scores than non-asthmatic children.

On the Child Behavior Checklist, completed by parents, mothers of asthmatic children reported significantly higher child internalizing symptoms and child externalizing symptoms than mothers of non-asthmatic children.

Mothers of asthmatic children also reported higher levels of general maternal psychopathology on the Depression Anxiety and Stress Scale.

**Attention please! How breathing facilitates
attentive processing of visual and auditory stimuli**

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In three studies, we investigated how breathing patterns changed from a relaxed state (baseline) to a state in which people processed series of pictures, environmental noises, musical excerpts, and film clips that varied widely in content and levels of pleasure and arousal.

The median change in total breath duration (T_{tot}), inspiratory volume (V_i), mean inspiratory flow (V_i/T_i), minute ventilation (MV), and percent rib cage (%RC) from baseline was calculated for each participant. A Wilcoxon signed rank test against the null hypothesis of no change (change score = 0%) was then carried out.

For all stimulus categories, T_{tot} decreased (median decrease: 8-10%, p 's<.001), and MV increased (5-10%, p 's<.01). V_i decreased for noises (2%, p <.01), music (3%, p <.05), and films (3%, p <.01), but not pictures (p >.3). V_i/T_i increased for pictures (12%, p <.01), music (5%, p <.01), and films (6%, p <.05), but not noises (p >.1). Abdominal breathing augmented for pictures and films (4%, 10%, p 's<.001), less for music (2%, p <.05), and remained unchanged for noises (p >.2).

Increases in MV were accomplished preferentially by a marked increase in respiratory rate and a decrease in volume with respect to a relaxed baseline state. This breathing pattern may serve behaviourally adaptive purposes, because it minimizes the amplitude of respiratory movements and thereby leads to a minimal degree of interference with the behavioural requirements of the task.

A marked shift toward increased abdominal breathing was observed for stimuli with a visual component. For purely auditory stimuli, this shift was virtually absent. These differences in the thoracoabdominal pattern might reflect a sensory modality effect or differences in attentional involvement across the four stimulus categories.

No symptoms, no asthma: self-regulation beliefs and behaviors among inner-city asthmatics

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Background: Asthma morbidity and mortality is highest in the inner-city. We used the Leventhal Self-Regulation model to assess beliefs and behaviors among inner city adults with persistent asthma.

Methods: A prospective cohort of all adults hospitalized with asthma 9/01 to 9/02 were interviewed (28% in Spanish).

Results: 204 Pts (94%) consented. Mean age was 50 (19-86), 78% female, 62% Hispanic, 28% African-American, and 5% White.

The mean ED visits and hospitalizations in the last year were 3.4 and 1.4.

One-third of Pts did not think they would always have asthma, and 54% felt they only had asthma when symptomatic (SX)—the "No SX, No Asthma" belief.

Pts attributed to asthma: wheezing (95%), shortness of breath (86%), cough (65%), stuffy nose (36%), and headache (19%).

Pts with a "No SX, No Asthma" mental model were: more likely to say they won't always have asthma, more likely to expect to be cured, less likely to say their lungs were always inflamed, and less likely to say chronic inhaled corticosteroids (ICS) were important if asymptomatic (ASX; $p < .05$), but not associated with thinking ICS use was important when SX—as the theory predicts.

Patients with the "No SX, No Asthma" belief were less likely to: use ICS when ASX, make routine doctor visits when ASX, and use peak flow to adjust ICS ($p < .05$). Among the 65% of Pts on ICS, 84% felt it was important to use when SX v. 58% when ASX ($p < .05$).

Nearly half were very worried about becoming addicted to ICS. 61% felt asthma would only be controlled when a new medicine was discovered.

Believing ICS was important to use when ASX was strongly predictive of ICS adherence ($R = .81$, $p < .001$).

Discussion: Educational interventions to improve care should target suboptimal mental models of asthma and its treatment.

Blunted Perception of Methacholine Bronchial Provocation in Adolescents who Survived Life-threatening Asthma

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Because the risk of death from asthma peaks during adolescence, we have been testing our hypothesis that some adolescent asthmatics have innate deficiencies in their abilities to detect respiratory compromise during episodes of acute severe asthma.

We have done methacholine bronchial provocation in 47 subjects (age 12-18 years) who had been admitted to intensive care units for episodes that fit criteria (McFadden, Am J Respir Crit Care Med 168: 740, 2003) for acute severe asthma.

Episodes in 8 of these adolescents were defined as life-threatening because they also required endotracheal intubation and assisted ventilation. Five of these 8 subjects in the life-threatening asthma (LTA) group had been admitted to intensive care units more than once, but not more recently than 6 months (average 3 years) before the study.

Baseline forced expiratory volume in one second (FEV1) was 89 +/- 15 % of predicted in the LTA group versus 88 +/- 18% predicted (NS) in the remaining 39 subjects (ASA group).

A modified Borg scale elicited degrees of "breathing difficulty" after each step of the doubling-dose methacholine provocation, which was stopped when the FEV1 had dropped by 20% of its baseline value.

The subjects reached their endpoints at very low provocation doses of methacholine (1.9 +/- 4.3 mg/ml in the ASA group versus 0.8 +/- 1.1 in the LTA group, NS), indicating extreme airways hyperreactivity in both groups.

However, the change in Borg score from the beginning to the endpoint was significantly ($P < 0.02$) smaller in the LTA group (0.1 +/- 1.6) as compared to the ASA group (1.7 +/- 1.8).

The two most frequently chosen descriptors of the breathing difficulty rated by the ASA group were "My breath does not go in all the way" and "My chest feels tight".

Conclusion: among adolescent asthmatics studied while asymptomatic after admissions to intensive care units for acute severe asthma, the additional history of assisted ventilation is associated with a blunted perception of methacholine bronchial provocation.

Gene expression and respiratory parameters during specific breathing exercises: A pilot study

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Breathing practices, such as those that originate from yoga, have been shown to have favorable effects on different health parameters. The effect of breathing practices has so far been scored by physiological or psychological end-points.

Since ultimately all phenotypic changes in the physiology are based on changes in gene expression, we hypothesize that the physiological effects of breathing practices are due to changes in the gene expression profiles, both short- and long-term.

Accordingly, we expect that significant changes in gene expression arise during the practice of specific breathing exercises in the peripheral blood lymphocytes (PBL) of practitioners.

In two subjects who are experts in yogic breathing practices, we have measured global changes in gene expression in the PBLs before and after advanced yogic breathing practices using cDNA microarrays.

In each subject, we can document changes, either up- or down-regulation, of approximately 500 genes. The changes in some genes are especially striking, reaching 20-25-fold differences before and after the practice.

Testing of additional subjects are under way; the common changes in gene expression profiles and the possible link of these changes to the physiological effects of the breathing practices will be presented.

Breathing exercises to enhance cerebral blood flow

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A program of breathing exercises was developed with the aim of increasing cerebral blood flow (CBF).

The main ingredient is the increase of PaCO₂ in the arterial blood, which leads to a significant raise of CBF. The theoretical background, analysis and evaluation of existing experimental data is presented.

Preliminary results of experiments done in a collaboration between the Pneumology Unit and the Physics Department will be presented.

Gender differences in the relationship between Negative Affectivity and subjective symptom reports

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We studied the association between Negative Affectivity (NA) and a broad array of 73 individual symptoms.

In a first step, each symptom was rated on a set of potentially relevant characteristics. Psychologists scored each symptom on the extent to which it (1) refers to a specific location in the body ("vagueness"), (2) may refer to both a physical condition and a negative emotion ("content overlap") and (3) is likely to be a physiological manifestation of anxiety ("anxiety").

Also medical doctors rated each symptom on "anxiety", as well as on (4) the probability that the symptom is caused by a somatic pathology ("somatic pathology") and on how benign versus serious the symptom is in terms of (5) life-threatening or (6) quality of life.

Healthy students scored each symptom on (7) how worried they would be if they would experience the symptom in daily life ("worrying").

A factor analysis on these symptom characteristics yielded 2 factors that explained 75% of the variance. "Worrying", "life-threatening" and "quality of life" loaded highly on the first factor, which could be interpreted as "Severity" of a symptom. "Somatic pathology" and "anxiety" loaded highly on the second factor, which was interpreted as "Somatic versus Psychic" cause of the symptom.

In a second step, a sample (N = 1017) of young, healthy students completed the 73-items symptom checklist and two trait NA measures. The correlations of individual symptoms with NA were highly variable and the pattern differed for men and women.

Whereas a symptom's association strength with NA could be predicted by both symptom factors ("Severity" and "Somatic-Psychic"; $R^2 = 52\%$) in women, only the second factor was a significant predictor in men ($R^2 = 11\%$).

These results clearly indicate that (1) NA should not be considered as general complaining factor and that (2) important gender differences in somatization processes exist.

Social cognitive determinants of participation in an asthma self-management program

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Asthma education programs improve asthma treatment results significantly. Low participation of asthmatics is a recurrent problem that impedes the efficiency of those programs.

In this study, determinants of participation in an asthma program were analyzed from a social cognitive perspective.

Ninety-eight asthmatic outpatients (age 18-65, 40% male) were invited to participate in an asthma self-management program. The patients received a standard description of the program.

Based on the ASE-model (de Vries H, et al., Health Education Research 1988;3:273-282), the patient's attitude towards the program (perceived benefits), self-efficacy expectations (perceived barriers) and social influence to participate in the program were assessed in a structured interview. Additional psychosocial variables were evaluated by means of questionnaires.

Fifty-four of the 98 asthmatics expressed their intention to participate.

Multiple logistic regression analyses resulted in a model explaining 74% of the variance (Nagelkerke $R^2 = 0.74$).

Believing in the benefits of the program was the best predictor of participation ($p < 0.001$), followed by few barriers to participate ($p = 0.002$) and a high general knowledge about asthma ($p = 0.007$).

Participation was not significantly determined by social influence.

We conclude that recruitment of asthmatics for an asthma program should focus on the perceived benefits patients have towards the program.

Respiratory Complaints in Chinese: cultural and diagnostic specificities

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Study objectives: We investigated the underlying dimensions of a wide range of Chinese descriptors of dyspnea and associated symptoms, and their relevance for clinical diagnosis.

Measurements: Sixty-one spontaneously reported descriptors were elicited in Chinese patients to make a symptom checklist, which was administered to new groups of patients with different cardiopulmonary diseases, to patients with medically unexplained dyspnea and to healthy subjects.

Results: Test-retest reliability was satisfactory for most of the descriptors. A principal component analysis on 61 descriptors yielded eight factors: dyspnea-effort of breathing, dyspnea-affective aspect, wheezing, anxiety, tingling, palpitation, coughing and sputum, and dying experience.

Though the descriptors of dyspnea-effort of breathing resembled western wordings and were shared by patients with a variety of diseases, the descriptors of dyspnea-affective aspect appeared more culturally specific and were primarily linked to the diagnosis of medically unexplained dyspnea, whereas wheezing was specifically linked to asthma.

Conclusions: Three factors of breathlessness were found in Chinese. The descriptors of dyspnea-effort of breathing and wheezing appear to be similar to Western descriptors, whereas the dyspnea-affective aspect seems to bear cultural specificity.

Accuracy of respiratory symptom perception in different affective contexts.

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Accuracy of respiratory symptom perception was investigated in different affective contexts in participants (N=48) scoring high or low for negative affectivity (NA).

Within subject-correlations were calculated between respiratory volume and the subjective rating 'deeper breathing', and between breathing frequency and the subjective rating 'faster breathing' across 9 subsequent breathing trials of 80 sec.

Three trials implied breathing room air, three trials consisted of 7.5 % CO₂-enriched air and three trials of 10 % CO₂-enriched air. Each air mixture had either a pleasant or unpleasant smell.

Half of the participants were tested in a positive affective context (positive information "the air mixtures may induce a pleasantly arousing feeling", while pleasant odors were added) and the other half in a negative affective context (negative information "the air mixtures may induce an unpleasantly arousing feeling", accompanied with foul smelling odors).

High NA persons were less accurate overall than low NA persons in the perception of the respiratory volume.

For the accuracy of the perception of breathing frequency, an interaction was found between NA and type of trial: High NA persons were less accurate in the negative context than in the positive one. For low NA persons, no difference was found between the positive and negative context.

The findings replicate and extend earlier findings in our group (Van den Bergh et al., Psychology and Health, 2004).

Visual or auditory attentional bias for asthma-cues in asthma?

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Almost 50% of asthmatic patients show a poor relationship between their symptom reports and lung function parameters. Some report symptoms in excess of pulmonary pathology; others have no complaints while being severely obstructed.

We investigated whether attentional biases for asthma-related cues exist in an asthma-population using two paradigms.

We used a visual dot-probe task with word pairs combining asthma-related, negative or neutral words. Word pairs were presented for 500 ms, then one of the words was replaced by a dot. Participants were instructed to react as quickly as possible to the dot by pressing a lever up or down, depending on the position of the dot.

The other paradigm used 500 Hz tones presented in the left or right ear of the participant, the tones being presented during distractor sounds. As distractor sounds, we used a fragment of quiet tidal breathing and a fragment of more rapid breathing with strong wheezing sounds.

In addition, we collected data on participants' ability to perceive asthma symptoms during a histamine challenge and compared these data on symptom perception with reaction times on the attentional task.