FROM THE EDITOR IN CHIEF | MESSAGE DE LA RÉDACTRICE EN CHEF

ORIGINAL ARTICLES
Applying a Chronic Disease Paradigm to Safe and Effective Treatment of Tobacco Addiction
Lung Association’s Ottawa COPD Program: a Successful Maintenance Pulmonary Rehabilitation Program
Respiratory Muscle Aids to Avert Respiratory Failure and Tracheostomy: A New Patient Management Paradigm
Design and Implementation of an Innovative ‘C4 Program’: Competency Assessment, Communication, Continuous Learning and Career Planning for Respiratory Therapists at Vancouver General Hospital
RRTs - A Sight for Sore Eyes - Manitoba’s First Opthalmic Sedation Practitioner

DIRECTED READING ARTICLE
Surfactant Therapy

COLUMNS / CHRONIQUES
Students Column – Promoting our Profession Begins as Students / La promotion de notre profession commence dès le début des études
Leadership Column - Canadian Team Provides Respiratory Training in China / Une équipe canadienne offre une formation en santé respiratoire en Chine
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Throughout our careers, respiratory therapists engage in a variety of activities and learning experiences that contribute to, and reflect our commitment to maintaining high standards within the profession. These activities range from attending conferences, taking courses and providing volunteer service within the professional associations.

With the introduction of the new FCSRT – the CSRT Fellowship designation, RTs have one more excellent reason to reflect on the contents of the Canadian Journal of Respiratory Therapy. Reading the journal will not only broaden your knowledge, but will gain you one credit per hour towards the 25 credits required per year to maintain this new professional designation. Writing an article for the CJRT, along with improving your professional competence, will also constitute two credits for every hour. These continuing education activities are not just part of a RTs life-long learning process, but now - also a means to acquire and maintain this additional professional designation. Information on the FCSRT, application form and criteria can be found on the CSRT website.

The CJRT is an excellent venue for RTs to update, improve and maintain their professional knowledge through reading research reports, directed readings, scientific papers and articles of interest. With the changes to the CJRT that we embarked on this spring, the journal has now become a knowledge dissemination tool that provides a wealth of relevant information. In this issue of the journal we present an article entitled “Applying a Chronic Disease Paradigm to Safe and Effective Treatment of Tobacco Addiction” by Charl Els, who explores issues surrounding tobacco addiction and a rational approach to treatment. Mika Nonyama, discusses COPD treatment, maintenance and rehabilitation in a paper called “Innovative Approaches in Any Area of Respiratory Therapy Practice or Education”. We have also included a directed reading article on “Surfactant Therapy” presented by Dr. Jack Haitsma, who discusses the role of surfactant in the lung, the difference between natural and synthetic surfactants as well as why surfactant therapy is only used for neonatal RDS.

The reader can find articles of relevance to RTs. “Respiratory Muscle Aids to Avert Respiratory Failure” written by John Bach in which he describes the use of noninvasive inspiratory and expiratory muscle aids to prevent ventilatory insufficiency and failure, and to permit the extubation and tracheostomy tube decanulation of “unweanable” patients. The article called “Design and implementation of an innovative ’C4 Program’: Competency assessment, Communication, Continuous Learning and Career Planning for Respiratory Therapists at Vancouver General Hospital” was written by Shari McKeown. This article includes discussion on performance appraisal, staff development, career mobility, personal loyalty and program development.

“Ophthalmic Sedation Practitioner” written by Alison Pagsuyuin, recounts her challenges of becoming the first RT in Manitoba to become an Ophthalmic Sedation Practitioner.

As in all previous issues of the CJRT, we provide abstracts of current literature and the following regular columns including a Leadership Column, by Michael Lemphers is entitled “Canadians Provide Respiratory Training in China”. Michael discusses the challenges faced in creating a teaching environment that is effective in the developing world. Student Krystle Hong has written an article entitled “Promoting our Profession Begins as Students” in the Student Column. Krystle discusses the advantages of becoming a student member of the CSRT. The Educator’s Column, was written by Mary Parrott, called “A Student Centered Approach to Scheduling”. Mary discusses various unique strategies to facilitate student success at the College of the North Atlantic Qatar (CNAQ).

We encourage individuals, groups and students to consider submitting case studies, research papers, book and literature reviews, commentaries and articles of interest to the CJRT. Publishing is a cornerstone to the profession and helps to further the respiratory therapy profession as well as advance our practices and procedures. Peer reviews of papers help authors hone their writing skills and maintain the integrity of material published in the journal. Manuscripts can be forwarded at any time to rhansen@csrt.com. Guidelines for writing papers are available on the CSRT website. Please feel free to contact me at any time with ideas, comments or suggestions at amy.cjrt@gmail.com.
Tout au long de leur carrière, les thérapeutes respiratoires s’engagent dans divers activités et apprentissages qui témoignent de leur promesse de maintenir des standards élevés pour la profession. Ces activités s’étendent de la présence à des congrès et à des cours jusqu’aux services bénévoles au sein d’associations professionnelles.

Avec la venue du nouveau programme de Fellowship de la SCTR, les TR ont une raison de plus de s’intéresser au contenu du Journal canadien de thérapie respiratoire. La lecture du journal ne sert pas uniquement à élargir les connaissances, mais elle accorde aussi un crédit par heure, lesquels s’ajoutent aux 25 crédits annuels nécessaires au maintien du nouveau titre professionnel.

La rédaction d’un article pour le journal, tout en améliorant les compétences professionnelles, accorde aussi deux crédits par heure de travail. Ces activités de perfectionnement continu ne font pas seulement partie d’une démarche d’apprentissage à long terme pour les TR; elles sont aussi un moyen d’acquérir et de conserver le nouveau titre d’associé. Le site Web de la SCTR fournit de l’information sur le titre d’associé, et présente les formules d’inscription ainsi que les critères d’admission au titre.

Le journal est une excellente façon pour les TR de mettre à jour, d’améliorer et de ne pas oublier leurs connaissances grâce aux rapports de recherche, aux lectures dirigées, aux documents scientifiques et aux articles divers. Par les modifications qui lui ont été apportées au printemps dernier, le journal est devenu un outil de diffusion de la connaissance qui fournit une mine de renseignements utiles. Le présent numéro présente un article intitulé Applying a Chronic Disease Paradigm to Safe and Effective Treatment of Tobacco Addiction par Charl Els, explore les éléments de l’accoutumance au tabac et une approche de traitement rationnelle. Mika Nonyama, aborde le traitement de la MPOC et de la rééducation dans un document intitulé Innovative Approaches in Any Area of Respiratory Therapy Practice or Education.

Nous avons aussi inclus une lecture dirigée, Surfactant Therapy, présentée par Jack Haitsma qui aborde le rôle du surfactant dans les poumons, la différence entre les surfactants naturels et synthétiques et explique pourquoi le traitement par surfactant est utilisé seulement pour le SDR néonatal.

Nous présentons aussi des articles qui intéresseront les TR. Respiratory Muscle Aids to Avert Respiratory Failure par John Bach décrit l’utilisation d’outils d’aide à l’inspiration et à l’expiration non invasifs pour prévenir l’insuffisance ventilatoire et pour permettre l’exubation et la décanulation du tube de trachéostomie des patients non "sevrables". L'article intitulé Design and implementation of an innovative C4 Program: Competency assessment, Communication, Continuous Learning and Career Planning for Respiratory Therapists at Vancouver General Hospital a été rédigé par Shari McKeown. Il aborde l’évaluation du rendement, la formation du personnel, la mobilité professionnelle, la loyauté du personnel et l’élaboration des programmes. Dans Ophthalmic Sedation Practitioner, Alison Pagsuyuin raconte son expérience à titre de première TR du Manitoba à pratiquer la sédation ophtalmique.

Comme dans tous les numéros précédents du Journal, nous présentons des résumés de publications courantes et des chroniques régulières :


Nous invitons les individus, les groupes et les étudiants à soumettre au Journal des études de cas, des documents de recherche, des critiques de livres et des commentaires ou des articles pouvant intéresser les TR. Les publications sont la pierre angulaire de la profession et aident à la faire avancer, tout en faisant évoluer nos pratiques et nos procédures. La révision par les pairs aide les auteurs à parfaire leurs compétences de rédaction et à hauser l’intégrité du matériel publié. Faites parvenir vos textes à rhansen@csrt.com. Vous trouverez des directives de rédaction sur le site Web de la SCTR. N’hésitez pas à communiquer avec moi pour formuler vos idées, vos commentaires et vos suggestions : amy.cjrt@gmail.com
ABSTRACT

Tobacco consumption remains the leading preventable cause of death, disease and disability. Nicotine is the chemical compound sustaining tobacco addiction, a lethal chronic disease, and the major cause of other prevalent chronic diseases. The downward trend of prevalence rates in Canada appears to have levelled with smoking rates hovering at 18%. Of those individuals who currently smoke, 70% would like to stop and half will try to quit at least once this year. But unless provided with evidence-based and multimodal treatment, only 3-5% of individuals who try will be abstinent six months later. International standards recommend treatment that includes offering combinations of counselling and pharmacotherapy for every individual wanting to quit.

But unlike other chronic diseases, most individuals with tobacco addiction are often precluded from treatment because prevailing ideologies frame their disease as a “lifestyle choice”. This profound misinterpretation of a chronic disease poses a significant barrier to effective tobacco control and a major contributor to unsustainable growth in excess health spending across Canada. Our existing tobacco control paradigm will likely not yield the desired health outcomes and cost savings until policy and clinical practice are aligned with scientific evidence. Furthermore, an urgent need is identified to incorporate an increased level of vigilance for depression and other neuropsychiatric issues has been identified.

This manuscript outlines the health professional’s legal duty to treat and introduces a single algorithmic approach to achieve such. This integrated and unified approach is aimed at defragmenting current approaches by crossing disciplines and levels of care. This guide for safe and effective treatment delivery may be particularly appropriate to resource-scarce settings.

ORIGINAL ARTICLE

Applying a Chronic Disease Paradigm to Safe and Effective Treatment of Tobacco Addiction

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Associate (adjunct) Professor: School of Public Health, University of Alberta

Conflict of Interest Disclosure:
Up to 2009 Dr. Els received unrestricted funding for research and education from the makers of smoking cessation medication: Johnson & Johnson and Pfizer.

Diane Kunyk
RN, MN, PhD(c)
Faculty of Nursing: University of Alberta

Conflict of interest disclosure: None.

Funding: This manuscript was funded in part by the Alberta Cancer Legacy fund: Tobacco Reduction and Cessation (TRaC II) Project: Alberta Medical Association / Primary Care.
INTRODUCTION

Tobacco remains the only legal consumer product that will kill at least one out of every two of its regular users when used exactly as intended by the manufacturer. In the general population, the health dangers of smoking tobacco are well known and the pillars of comprehensive tobacco control, established and proven to remedy the tobacco epidemic, are broadly publicized and disseminated. Yet progress in reducing the rate of smoking appears to be leveling off with 18% of the Canadian population older than age 15 smoking (1). Tobacco control is at a crossroads and updated policies and paradigms, those that provide greater emphasis on cessation, are needed to stimulate further progress.

Nicotine is the chemical compound sustaining addiction to tobacco (2). Tobacco addiction (nicotine use disorder, nicotine dependence, or tobacco dependence) is widely recognized as a chronic condition, and the major cause of other prevalent chronic diseases. As cigarette smoking is the predominant nicotine delivery mechanism in persons addicted to nicotine, it also is a direct and major contributor to the three leading causes of death in Canada: circulatory system diseases, cancer, and respiratory system diseases (3). Smoking remains the single most important risk factor for respiratory disease, including chronic obstructive pulmonary disease (COPD), with mortality of COPD seven times higher in smokers than in non-smokers (4). As with other risk factors related to the metabolic syndrome, tobacco consumption has been recognized as a bona fide contributor to the development of diabetes and hypertension (5).

Chronic diseases (i.e. those conditions of an ongoing or recurrent nature) pose a vast challenge to health professionals, policy makers, and governments. The World Health Organization (WHO) estimates that 60% of all deaths worldwide result from chronic disease and, with the increasing age of the general population in Canada, so does the prevalence of chronic disease. The estimated cost, direct and indirect, related to substance use and misuse totaled almost $40 billion CAD in 2002, and almost half of this was attributable to tobacco smoking (6). The rise in prevalence of chronic diseases, changes in clinical treatment thresholds, along with the plateau in numbers of smokers and their recalcitrance (7), may well predict even greater demands on the health care system in the years ahead.

This review aims to summarize updated treatment approaches to tobacco addiction, including pharmacotherapy and psychosocial interventions, within a broader tobacco control framework and against the backdrop of empirical cessation policy-related elements. It will introduce into Canadian literature an algorithmic approach to tobacco addiction treatment that crosses the levels of care and will also introduce the concept of health professionals’ legal duty to treat tobacco addiction.

Tobacco addiction is a bona fide chronic disease: The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) categorizes nicotine dependence as a mental condition (disorder) in the category of substance-related disorders. A positive diagnosis is made when 3 or more of the following 7 criteria are met within a 1-year time span: Tolerance, withdrawal, smoking more than usual, a persistent desire to smoke despite efforts to decrease intake, extensive time spent smoking or purchasing tobacco, postponing work, social, or recreational events in order to smoke, and continuing to smoke despite health hazards (8).

Nicotine exerts a strong behavioural influence, and this contributes to the erroneous perception that tobacco addiction is purely a choice. Individuals who smoke do not wake up every morning to make a deliberate choice to spend $10-$20 per day, or roughly $4000 per year for a pack-a-day smoker, to buy cigarettes, or to continue to invest in an industry that was recently been found guilty of criminal activities in Canada and elsewhere in the world. Viewing consumption of tobacco as simply a choice, failing to take the chronic disease nature of the condition into account, has led to the misguided notion that individuals should first try to abstain from smoking in an unaided way, or first to read a brochure to quit, and only after repeated failures should they be allowed to access treatment.

Tobacco (nicotine) dependence is recognized as a chronic disease by most authorities, including Health Canada, the Canadian Medical Association, and the World Health Organization, and is classified as such in major disease classification systems (9). Following chronic exposure to nicotine, profound psychophysiological changes occur. Comparing tobacco dependence with another chronic disease outlines some of the common characteristics these two conditions may share.

Addiction is a preventable and treatable disease, as opposed to a simple “choice”, a “lifestyle issue”, a social problem, a lack of education, or purely of culpable behavior (in terms of own health and the damage inflicted). Scientific evidence has identified that addiction develops as a result of a complex multi-factorial interaction between repeated exposure to drugs, and biological, psychological, spiritual, environmental factors. The belief that addiction is self-afflicted and self-modifiable, often perpetuated by well-intentioned but inappropriately credentialed tobacco control advocates, has contributed to the limited access tobacco addiction treatment seen across Canada. Current policy measures and lack of pharmacotherapy coverage are symptomatic of governments’ failure to take into account the neurological changes nicotine dependence has on motivation pathways in the brain.

The conventional view of addiction has been described as “impaired control over a reward-seeking behavior from which harm ensues” (10), and as “repeated failures to refrain from drug use despite prior resolutions to do so” (11). Addiction refers to a psychiatric syndrome, induced by exposure to a particular drug, which produces chronic changes in the brains “motivational system” as a consequence of which “a reward-seeking behavior has become out of control” (10). This complex brain disorder results from the chronic effects of a specific (addictive) drug on the brain’s structure and function.
Decision-making and behavior are subsequently influenced by the underlying pathophysiological changes in the brain. A variety of biological (including genetic), psychological, spiritual, and social contextual factors modulate these changes in the brain.

Tobacco addiction is perpetuated by the ability of cigarettes, by design, to rapidly introduce nicotine and a host of other chemicals to the “addiction centers” of the brain, i.e. the reward pathways. To increase the addictive nature of nicotine, smoked tobacco (by rational design of cigarettes) delivers nicotine in a partially free-based format to the brain. After nicotine’s delivery through the arterial system to the brain, it binds primarily to alpha-4 beta-2 (α4β2) nicotinic receptors. These receptors, naturally a ligand for acetylcholine, are central to the initiation and maintenance of addiction. Stimulation of these nicotinic receptors causes the generation of an action potential that stimulates other brain centers, and this results in the release of dopamine in the “pleasure center” of the brain. When chronically stimulated by nicotine, up-regulation and desensitization of these receptors follow (12). Over time, the entire reward pathway can become desensitized, and represents a second major maladaptive change in brain function in response to tobacco administration.

Unlike other chronic diseases, most persons who smoke do not receive treatment:

For the chronic disease of hypertension, 80% of Canadians receive evidence-based treatment, and 66% of persons with hypertension are successfully treated for their chronic condition (13). For tobacco addiction, the treatment rates are substantially lower and, unlike that for hypertension and other chronic diseases, is not universally covered for related cost nor is it readily available, accessible or affordable. Seventy per cent of persons who smoke say they regret ever starting and would like to give it up, and 50% of smokers will make at least one cessation attempt per year (14). Most (64%) who attempt to quit will try to do so unaided (14), and reduction of consumption is the most common strategy most persons who smoke will use in their quit attempts (14). It is erroneous to suggest that because unaided cessation is the most common method employed, it is the most effective one to achieve abstinence. Fewer than 20% of smokers receive pharmacotherapy for the treatment of this condition and, without treatment (i.e. unaided) only 3-5% of persons attempting to quit will remain abstinent from tobacco at 6 months (16). The suggestion that the first-line of treatment of chronic disease should be an “unaided” one may be viewed as tantamount to negligence by clinicians.

Tobacco smoking has been singled out as the leading preventable cause of death and disease but in reality other contributors to metabolic syndrome and/or chronic diseases rarely occur in isolation of each other. Hypertension, hypercholesterolemia, obesity, diabetes, depression, tobacco smoking, respiratory complaints and a sedentary lifestyle frequently co-occur. Many Canadian treatment systems remain trapped in archaic silos of managing one disease at a time, and this presents another barrier for access to treatment. It is not uncommon to hear that treating tobacco addiction “is not my job”. Whose “job” is it?

Further, the use of a short-term, acute care paradigm to ‘cure’ any chronic disease is obviously flawed. Following a short-term paradigm for tobacco addiction is equally illogical and compromises the chances of cessation success. It is not expected that individuals with diabetes will be able to maintain blood glucose levels within desired parameters without ongoing monitoring and managements but, when it comes to smoking, individuals are expected to quit. Such practices are themselves an unfortunate legacy of the “just be strong” perspective that guided cessation attempts in the past. This ideology maintained that a “little bit of help is all you should need” given that “moral fibre” was the ultimate determinant of cessation success.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hypertension</th>
<th>Tobacco Use / Dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence</td>
<td>19%</td>
<td>17%</td>
</tr>
<tr>
<td>Percentage of sufferers receiving treatment (pharmacotherapy)</td>
<td>80%</td>
<td>&lt;20%</td>
</tr>
<tr>
<td>Mortality rates</td>
<td>1%</td>
<td>50%</td>
</tr>
<tr>
<td>Causes / contributes to multiple secondary diseases or conditions?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cost-effective, safe and effective multimodal treatment available?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Psychosocial interventions should include psychoeducation and lifestyle change recommendations?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Polytherapy (medication combinations) endorsed as safe and effective?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Typical duration of treatment in practice.</td>
<td>Open-ended; &quot;As long as it takes&quot;, often life-long.</td>
<td>Mostly no treatment, otherwise less than 3 months.</td>
</tr>
<tr>
<td>Coverage for pharmacotherapy on provincial formulary?</td>
<td>Universal</td>
<td>Exception.</td>
</tr>
</tbody>
</table>
Contemporary best practices are shifting to reflect a far more realistic understanding of the nature of tobacco addiction and the processes required to successfully manage this disease condition. The most rational approach is reflected in a dovetailing of various interventions within a broader tobacco control strategy and including treatment across the continuum of care delivery. Such strategies can be developed and implemented in a highly time-efficient manner and have demonstrated clinical effectiveness (17). A recent Cochrane review showed that full coverage of smoking cessation medications significantly improved one-year abstinence rates among all smokers (RR 2.45, 95% CI 1.17-5.12) (18), with the potential for almost 2 million life-years gained in Canada (19). The cost per life year saved is small compared to the gains, and the number of individuals needed to treat to save one life is nine (20), and this makes smoking cessation one of the most robust and clinically meaningful interventions any health professional can offer.

Tobacco addiction is “chronic disease by design” driven by a powerful vector: This pandemic of tobacco-related diseases is transmitted by an industry which serves as its vector. The vector is maintained by the industry’s greed - unparalleled in its capacity to induce suffering and unirrivalled in its amoral duplicitous conduct as it seeks to maintain profits of billions of dollars. Over the past 50 years, the tobacco industry has strenuously rejected any responsibility for the devastating health consequences of its products. It has been characteristic of the industry to consistently seek to subvert, distort and denigrate all of the evidence that has accumulated regarding the lethal nature of its products. It has frequently conspired with tobacco industry-friendly scientists and physicians with the sole aim to cast doubt on the link between tobacco use and the array of resulting disease states, the risks of second-hand smoke, and the addictive nature of nicotine. This collaboration has sabotaged public health efforts and continues to do so. The tobacco industry were recently criminally convicted for their actions in the contraband industry that plagues Canada today.

Although the tobacco epidemic is a 20th century phenomenon, the contemporary presence of tobacco on the Canadian market remains a historical anomaly. If tobacco products were introduced to the market for the first time today, they would be rejected as unfit for human consumption and would not be a legal product. Tobacco smoke contains 172 toxic substances, 33 hazardous air pollutants, 47 chemicals restricted as hazardous waste, and 67 known human or animal carcinogens in tobacco (21). It has no sustaining value to life. Yet tobacco continues to escape most of the governmental regulatory mechanisms developed to protect the Canadian public and its health from dangerous consumer products and medications.

Tobacco addiction is an “addiction by design” (22), and hence a “chronic disease by design”. This rationally designed and maintained chronic disease yields billions of dollars in profit but at the cost of the public health care system. A former Commissioner of the US Food and Drug Administration aptly noted that the tobacco industry ought to be dismantled (23). The World Health Organization’s Framework Convention on Tobacco Control (24) urges the denormalization of the tobacco industry (25) while, at the same time, reducing the demand for tobacco through education, communication, enhanced public awareness, and the training of health professionals to facilitate the treatment of tobacco addiction on a broad scale.

Every person has the right to optimal health:

The WHO Constitution declares that “the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being” (26). Like with other chronic diseases, this right also belongs to every person who suffers from tobacco addiction. It is widely acknowledged that the single most important step in achieving optimal health is to stop using tobacco. This can only be fully realized by firstly recognizing that nicotine dependence is a chronic and treatable condition, and that it remains every health professional’s ethical and legal responsibility to help patients with this disease. The Canadian Society of Respiratory Therapists have recognized this responsibility. They collaborated with 8 other national healthcare societies and associations, including the Canadian Medical Association and the Canadian Nurses Association, to identify the role of health professionals in smoking cessation, and reinforce the need for a comprehensive, collaborative approach to treatment that is supported with resources and incentives (27).

Evidence-based treatments of tobacco addiction are considered safe, effective and remarkably cost-effective on Provincial jurisdictional level (28), and smoking cessation is considered the “gold standard” of preventive clinical interventions. Only nine smokers need to be successfully assisted with cessation in order to prevent one premature tobacco-related death (20). No other preventive interventions are known to be as robust and other preventive strategies, such as the control of hypertension or the treatment of dyslipidemia, require the treatment of vastly more patients to show a similar effect (20). Yet the rate of individuals managed for the chronic disease of tobacco addiction falls far behind that for other chronic disease conditions. Several factors may contribute to this including an unresponsive health system, and the lack of preparation of health care providers to treat, amongst others. The out-of-pocket costs associated with receiving treatment which affects the mentally ill to a greater degree than others who are less disenfranchised.

Our current status may be accounted for what the authors coin as the “shadow side of advocacy”, a counterproductive phenomenon. Canadian tobacco control strategies, despite vast successes, have contributed to stigma towards those with the disease (as an unintended consequence of denormalization and smoke-free policies), have advocated for requirements that unaided efforts be exhausted before treatment is offered, and the profound misunderstanding of tobacco addiction as a disease condition has not been addressed. As a result, governments and policy makers are often continuing to classifying smoking as a “lifestyle choice” and, when the disease condition is not recognized, excludes their responsibility to cover treatment.
WHAT IS A RATIONAL APPROACH TO TOBACCO ADDICTION TREATMENT?

The best results for tobacco addiction treatment are achieved with a comprehensive, multidisciplinary approach that assures the availability, affordability and accessibility to longitudinal and diversified psychosocial and pharmacological interventions. Further, effective interventions dovetail population-based interventions with individually based interventions. Empirically demonstrated successful population-based interventions include increasing the cost of tobacco through taxation, smoke-free policies, prevention of uptake, restrictions of sales, achieving parity of coverage of pharmacotherapy, and implementing comprehensive tobacco control programs. Existing tobacco control policies, by neglecting smoking cessation, have resulted in the situation whereby the most marginalized and vulnerable members of Canadian society have disproportional rates of smoking, and carry the burden of tobacco-related disease and mortality (28). The fact the most people quit smoking without any help is not a function of the effectiveness of unaided cessation but rather a reflection on the lack of access to evidence-based care. By increasing availability, accessibility, and affordability, massive gains are expected over and above the current plateau reached in reducing smoking rates in Canada.

Given the evidence of the effectiveness and safety of cessation interventions, including when provided for those with mental illness, our biggest challenge is not a lack of knowledge on how to treat this disease but rather to embrace policies that will improve the opportunities for intervention. Cessation policy development can indeed offer the greatest prospects for declines in smoking caused death over the next 30 years, and will most likely come from increasing adult cessation (29). Cessation policies, fully integrated into the health treatment system, have been shown to create the conditions to support tobacco dependence treatment that, by following best practice treatment guidelines, include provision for nicotine detoxification by using nicotine replacement therapy, treatment goals of abstinence, relapse prevention and relapse management, and offering treatment on a longitudinal paradigm consistent with other chronic relapsing medical diseases (29).

Incorporating tobacco dependence treatment into health organizational administration, on par with the management of other chronic diseases, is required to achieve the goal of reducing the prevalence of smoking and the impact of the chronic disease of tobacco addiction. Mechanisms to facilitate health providers with managing tobacco addiction include mechanisms to identify all individuals that use tobacco products, priming/prompting treatment, facilitating linkages to resources, identify options for help, and provide feedback on their performance. The greatest gains in treatment are expected to come from tailoring interventions to align the best evidence with the treatment situation. For example, a treatment algorithm in acute hospital settings may focus on identification, management of nicotine withdrawal and referral to treatment on discharge.

Integrating comprehensive psychosocial and pharmacological treatments improve outcomes, and should be offered to every smoker interested in making a cessation attempt. For that purpose, it is the duty of every jurisdiction and every system to ensure that resources are available to offer evidence-based psychosocial and pharmacological cessation interventions, of sufficient duration. Consultation-liaison services need to be available to ensure more complex cases are managed in an appropriate fashion, and sensitivity to particular gender and socio-cultural differences need to be taken into account in offering cessation interventions. A comprehensive discussion of these elements falls outside the scope of this manuscript.

Optimal tobacco control programs require an array of integrated strategies and interventions, including all pillars of tobacco control. The goal of reducing smoking prevalence rates requires a comprehensive and integrated approach, combining policies with evidence-based cessation policies. Cessation policies should include expanded cessation treatment coverage, mandated adequate funding for evidence-based quitlines (provided they are demonstrated to have achieved outcomes are per international standards) as well as web-based interventions, support for healthcare systems’ changes to prompt, guide, and incentivize tobacco treatment, support for improved individually tailored, stepped-care approaches, and long-term effectiveness of evidence-based treatments (29). Recent simulation modeling evidence (30) suggests that cessation treatment policies have the strongest effect on reducing prevalence rates, followed by cigarette tax increases, smoke-free air laws and mass media/educational policies. Appropriate levels of taxation, traditionally lauded for its impact, will continue to have a significant impact on deterring smoking (particularly among adolescents) while reinforcing commitments to cessation.

For cessation, evidence-based guidelines strongly support the so-called “5-A Approach” (31): consistent screening for, and documentation of, tobacco use (Ask & Assess); the provision of specific advice (A3) regarding the benefits of cessation; an offer of particular assistance (A4) with a cessation attempt (which entails pharmacotherapy and counselling); and arrangements (A5) for appropriate follow-up. This “5-A Approach” is considered standard: Ask, Assess, Advise, Assist, and Arrange follow-up. The consistent application of such a strategy is consistent with a longitudinal approach to the management of this chronic disease.

Clinical evidence supports the offer and provision of safe effective treatment to every person addicted to tobacco. A combination of simple, strategic behavioural counselling and pharmacotherapy should be offered to every smoker interested in quitting – and will significantly enhance the likelihood of a successful cessation attempt (32-34). Those who are not ready to make an attempt at cessation should be offered simple, sympathetic counselling designed to permit a reassessment of their reasons for continued smoking and an invitation to seek assistance with cessation at any time. Psychosocial and pharmacological interventions include:
A. Psychosocial interventions (31):
- Counseling (group or individual; office-based, telephone, or web-based) should be routinely offered in combination with medication in order to yield enhanced success in cessation outcomes. There is, however, the expectation for these programs to ensure that the content and mechanisms of delivery meet standards of care. This may not be occurring universally.
- Simple strategic advice regarding the avoidance of high risk situations for relapse, the recognition of settings or circumstances in which smoking has been particularly common, the management of acute cravings, and the development of family smoking guidelines for home and car are all important in accentuating the likelihood of cessation success.

Pharmacological interventions (31,35,36-38):
- Nicotine replacement therapy (NRT): Nicotine, albeit addictive, is safe and effective for the treatment of tobacco addiction, in a broad range of populations. Nicotine replacement therapy is available in Canada in four forms (transdermal patch, chewing gum, inhaler, and lozenge) and is not associated with the development of cancer. All smokers seek to maintain a certain, individualized level of nicotine; which may exceed the dose of 21mg, and which may include combinations of different NRT formulations at the same time. When nicotine levels fall, distinct and usually significant discomfort occurs (withdrawal symptoms) serving to overturn any conscious decisions to stop smoking. The provision of nicotine via the venous system, following its administration to the skin or mucous membranes of the mouth and throat, stimulates nicotine receptors and extinguishes the symptoms of withdrawal. This permits a would-be non-smoker to go about normal activities, free of the discomfort that normally occurs with cessation attempts. The concept of reduce-to-quit, i.e. cutting back while administering pharmacological nicotine, has gained popularity and enjoys on-label registration status in Canada, as a safe and effective method to help persons quit smoking.

The appropriate use of NRT (particularly when titrated to reflect a person’s individual need) is efficacious and usually doubles success rates. Combinations of NRT (i.e. use of the patch and gum, or patch and the inhaler) are further associated with increased levels of success. The scientific evidence does not support the use of alternative tobacco-based nicotine delivery systems, e.g. smokeless tobacco, or ‘smus’ as an aid to smoking cessation. Despite claims to the contrary, these are not considered to serve as a ‘harm reduction’ measure, and may discourage or postpone cessation efforts in smokers who would otherwise have quit, or may induce another form of tobacco dependency with associated health consequences, e.g. pancreatic cancer.

Although patients are usually discouraged from smoking while starting nicotine replacement products, pharmaceutical-grade nicotine alone does not pose an increased cardiovascular risk, even when combined with combustible tobacco products.
- Bupropion is a prescription medication initially registered and used as an anti-depressant. It was subsequently, and serendipitously, found to be effective in producing smoking cessation, and was subsequently tested and registered in this regard. Although its mechanism of action for smoking cessation is largely unknown, it is now understood that bupropion maintains levels of dopamine in the reward centers of the brain by inhibiting the reuptake of this neurotransmitter. It also affects levels of norepinephrine, a chemical known to be associated with the development of the symptoms of withdrawal. Bupropion has been shown to double the success rates of quitting smoking. It should not be used in persons with seizure disorder, those addicted to alcohol and at risk of withdrawal, and persons with eating disorders. It is also not be combined with the antidepressant formulation of the same drug.
- Varenicline is a third-generation smoking cessation pharmacotherapy. It directly and distinctly binds to the _4_2 nicotinic receptor, blocking the receptor sites (in exactly the same way that a key in a lock prevents the insertion of another key) while at the same time partially stimulating those same receptors. Thus, the _4_2 nicotinic receptor continues to transmit a neurological impulse that, while reduced in intensity, causes the release of small amounts of dopamine in the reward centers of the brain, but only at a strength of about half that of nicotine from a cigarette. As a result the smoker experiences little to no withdrawal symptoms, and if a cigarette is smoked, no pleasurable sensation is experienced (the ‘key in the lock’ prevents the nicotine ‘key’ from being inserted).

Varenicline may be superior for cessation when compared with NRT and bupropion. The odds ratio of quitting with varenicline is approximately 3:1, and current evidence suggests that it is not causally associated with a higher rate of neuropsychiatric adverse effects than placebo or bupropion, with the exception of the symptom of sleep disturbance (38). Most recently, the maintenance dose of 1mg bid po was supplemented with a lower maintenance dose of 1mg per day, or 0.5mg twice per day.

Bupropion (for depression) can be combined with varenicline, but the impact on smoking cessation remains speculative. Varenicline, cleared mainly by the kidneys and bypassing the hepatic cytochrome system, may be combined with the range of antidepressants, and no clinically meaningful pharmacokinetic or pharmacodynamic drug interactions are anticipated.

Towards Canadian Guidelines for Tobacco Addiction Treatment (31, 37):
At the 58th Annual Meeting of the Canadian Psychiatric Association, the Addiction Section of the CPA adopted the USDHHS (31) Clinical Practice Guidelines’ summary as a template for the guidance of their members as they
deliver smoking cessation treatments to their patients and communities. These are the set guidelines which are also supported by the Canadian Society of Respiratory Therapy on its website, and along with the Canadian Action Network for the Advancement, Dissemination and Adoption of Practice-informed Tobacco Treatment (CAN-ADAPT) (37). It offers a comprehensive guideline set with recommendations for a broad range of populations such as those with mental illnesses. The USDHHS guideline recommendations are summarized as follows:

1. “It is essential that clinicians and health care delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a health care setting.

2. Tobacco dependence (TD) is a chronic disease that often requires repeated intervention and multiple attempts to quit. Effective treatments exist, however, that can significantly increase rates of long-term abstinence.

3. Tobacco Dependence treatment (TDRx) is effective across a broad range of populations. Clinicians should encourage every patient willing to make a quit attempt to use the counseling treatments and medications recommended in this Guideline (see #6).

4. Brief TDRx is effective. Clinicians should offer every patient who uses tobacco at least the brief treatments shown to be effective in this section.

5. Individual, group, and telephone counseling are effective, and their effectiveness increases with treatment intensity. Two components of counseling are especially effective, and clinicians should use these when counseling patients making a quit attempt: Practical counseling (problem solving/skills training), and social support delivered as part of treatment.

6. Effective medications are available for TD, and clinicians should encourage their use by all patients attempting to quit smoking—except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents). Six (in Canada) first-line medications reliably increase sustained abstinence.

7. Counseling and medication are effective when used by themselves for treating TD. The combination of counseling and medication, however, is more effective than either alone. Thus, clinicians should encourage all individuals making a quit attempt to use both counseling and medication.

8. Telephone quitline counseling is effective with diverse populations and has broad reach. Therefore, both clinicians and health care delivery systems should ensure patient access to quitlines and promote quitline use.

9. If a tobacco user currently is unwilling to make a quit attempt, clinicians should use motivational treatments in increasing future quit attempts.

10. TDRx is both clinically effective and highly cost-effective relative to interventions for other clinical disorders. Providing coverage for these treatments increases quit rates. Insurers and purchasers should ensure that all insurance plans include the counseling and medication identified as effective as covered benefits”

Integrating outpatient and hospital-based algorithms: A single safety-sensitive, medically guided treatment algorithm (Figure 1), available at www.tracii.ca, was developed to assist with navigation of safety concerns related to quitting and pharmacotherapy, and to integrate outpatient and inpatient treatment, including withdrawal management and cessation. For hospital-based involuntary abstinence (which is not the equivalent of enforced cessation), the routine offering of nicotine is recommended to avoid withdrawal from nicotine even for persons not interested in extended abstinence from tobacco (i.e. quitting smoking). This is a similar approach to the management in hospitals of withdrawal from other substances (i.e. alcohol, benzodiazepines), representing a precursor to engagement in longitudinal abstinence, and should not be confused with disease treatment. Withdrawal management is not the same as smoking cessation. Prior to discharge, in the person on a nicotine agonist (nicotine replacement therapy), a referral should be made (and documented) to existing cessation programs, and one or more of the six medication options could be discussed as a cessation option along with linking the person with psychosocial counselling. As most individuals want to stop smoking, those who have successfully achieved short-term abstinence in hospital by managing nicotine withdrawal, particularly if supported to do so by health providers by providing the adequate dose of nicotine, typically in combinations with each other, may be more likely to be interested in accessing cessation interventions (32-34). Although most smokers are interested in quitting, only few are able to do so abruptly, and providing nicotine as a withdrawal management regime (prior to quitting) may offer the opportunity for some to change the behavioural components with greater success. This approach has been demonstrated to encourage subsequent quit attempts (32).

The assumption that patients admitted to smoke-free settings are either interested or ready to quit is erroneous, and the confusion between the management of withdrawal and cessation treatment prevails. Cessation treatment, as with any chronic, relapsing disease, requires a longitudinal treatment paradigm. The focus on withdrawal management in the hospital setting is a bona fide first step, with referral for longitudinal disease management, which may include hospital-based initiation of pharmacotherapy for this purpose, is more consistent with the evidence-based management of other chronic diseases, which includes addictions.

The algorithm offers a minimal investment scenario whereby the bare essential interventions include screening for nicotine dependence with every patient and routine detoxification management. This is paired with clear
communication that abstinence is not the same as cessation, and that the goal of the smoke-free environment is occupational health-driven. Support for avoiding involuntary withdrawal symptoms is offered, not for the initial purposes of cessation, and irrespective of interest in quitting smoking. This should be repeated and documented for the duration of the hospital stay, and for patients interested in exploring the extension of a treated (with NRT) abstinence state, to thus qualify as “cessation”, a referral is made to existing telephone-based, web-based, or other available cessation resources.

The algorithm proposes serial screening assessment with every individual that uses tobacco throughout the cycle of smoking and relapse. This step is considered necessary because there is significant co-morbidity between nicotine addiction and depressive symptoms, estimated at 40% to 60%. Furthermore, neuropsychiatric adverse event association with smoking cessation may be profound (38), including depressed mood and suicidal ideation. These are related to a likely confluence of a variety of factors, and may contribute to the risk of harm for a number of individuals, with or without mental illness. These neuropsychiatric considerations, including the most salient pharmacotherapy recommendations related to suicide and depression, are summarized at: [http://la-press.com/article.php?article_id=2191](http://la-press.com/article.php?article_id=2191)

A CASE FOR ACCREDITATION OF HOSPITAL-BASED SYSTEMS?

Like in the US, accreditation standards should include at least the screening for tobacco, offering of adequate withdrawal management, and a link to cessation treatment. Performance measurement of clinicians and hospital systems should be linked to screening for tobacco, detoxification management in involuntary abstinence states in smoke-free settings, and a referral to at least one cessation treatment system. Utilization of pharmacotherapy, i.e. prescriptions by physicians to smoking patients, should also be viewed as a performance indicator.

DO HEALTH PROFESSIONALS HAVE A LEGAL DUTY TO SCREEN FOR, AND TREAT TOBACCO ADDICTION IN PATIENTS UNDER THEIR CARE?

As the true disease nature of tobacco addiction becomes more recognized, and the availability of effective treatments become more known, so will the relevance to Canadian law. Health professionals are expected to exercise reasonable skill, care, and judgment in the care for their patients. In the context of the bona fide chronic medical condition of tobacco dependence, and where a duty to care exists, health professionals’ failure to exercise reasonable actions, may give rise to potential for legal challenges. The failure to diagnose, the failure to offer treatment, the failure to ensure continuity of care, or the failure to adequately advise of medical risks associated with the condition may foreseeable contribute to damages. Although this has not been tested in Canadian courts, at the time of this publication, sufficient grounds exists to suggest that health consumers may attempt to claim health professionals’ negligence in situations of a derelict of the duty, directly leading to damages because of the treatable condition of smoking.

Similar to the treatment of other chronic conditions, it is reasonable to assume that a health professional may have a duty-of-care tobacco dependence (TD) in his / her patient population. Failure to screen for this condition and offering of treatment options or referral options may constitute a failure to meet standards of care in some professions. This may include either primary treatment (Rx) provision, or ensuring continuity of care in the form of a referral to a safe and effective treatment service. Health professionals’ awareness of the potential risks may allow for mechanisms to ameliorate such, by incorporating evidence-based safe and effective tobacco addiction care into daily practice.

CONCLUSIONS

Tobacco addiction is not simply a lifestyle choice. It is a vector-driven chronic disease, which is prevalent, lethal and treatable - yet it is undertreated. Treatment is guided by validated guidelines, endorsing a range of safe and effective evidence-based treatment interventions. These typically include a combination of pharmacotherapy and counselling, in a longitudinal context, recognizing the true chronic disease nature of tobacco addiction. Yet, the majority of smokers remain untreated.

This chronic disease represents one of the most significant missed opportunities in health - the result of outdated concepts regarding the underlying mechanisms...
that perpetuate smoking and, in part, a legacy of the tobacco industries’ lavish and longstanding efforts to portray smoking as a matter purely of individual choice. Further, healthcare systems have not embraced the true nature of the condition, and compared to another chronic disease like hypertension, the management of tobacco dependence appears dismal.

The development of comprehensive approaches to tobacco addiction as a chronic disease, including the orphan of tobacco control policy development, will save lives and dollars. It is of fundamental importance that policy makers are made aware that assistance with cessation will be more effective and more cost efficient than programmes designed to ensure that smoking is never commenced. Both are obviously important but the magnitude of the health and economic benefits of cessation programmes delivered to the current cohort of smokers make the former strategy an important, and heretofore largely neglected, element of a contemporary approach to the tobacco disease epidemic. At a time of heightened economic pressure, such an approach will produce significant savings through reduced re-admissions, recurrences of illness, and progression of disease than any other preventive intervention.

Cessation interventions are markedly more cost-effective than virtually all other preventive treatments or interventions. It is no longer acceptable to use outdated techniques, or to permit antiquated attitudes that preclude the development and implementation of best practice solutions for the management of the leading cause of preventable disease, disability, and premature death in Canada. As is the case with other chronic diseases, the identification and treatment of tobacco addiction is now seen as a standard-of-care in Canada, and there is an implied element of negligence when clinicians deliberately ignore this duty-of-care related to tobacco addiction.

Persons suffering from tobacco addiction, a chronic medical condition, deserve nothing less than a systematic, empirically informed, and qualified approach, as discussed in this manuscript. This should be on par with treatment and approaches developed to treat other chronic diseases, some of which were considered untreatable only a few decades ago. The single most important factor in achieving this will be the full recognition of tobacco addiction as a bona fide, treatable medical condition. Empirically driven cessation policies, guiding safe and effective treatment interventions, within a healthcare system accountable to its consumers, have a tremendous potential to save healthcare dollars.

REFERENCES


Lung Association’s Ottawa COPD Program: a Successful Maintenance Pulmonary Rehabilitation Program

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Financial support: This study received funding from Ontario Lung Association. Dr. Brooks is supported by The Canada Research Chair in Rehabilitation for Chronic Obstructive Pulmonary Disease.

Financial disclosure: We certify that no party having a direct interest in the results of the research supporting this article has or will confer a benefit on us or on any organization with which we are associated AND, if applicable, we certify that all financial and material support for this research and work are clearly identified in the title page of the manuscript.

Conflict of interest: The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

ABSTRACT

Chronic obstructive pulmonary disease (COPD) is a respiratory disorder characterized by a progressive loss in lung function resulting in partially reversible airway obstruction. Pulmonary rehabilitation (PR) is a multidisciplinary program that includes the integrated components of exercise training and education and is recommended for all patients with COPD. Several guidelines and standards on the management of COPD recommend some sort of maintenance program after PR. The purpose of this paper is to report on an evaluation of a maintenance program. The Lung Association Ottawa COPD program acts primarily as a long-term maintenance program following comprehensive PR. It offers 7 sessions, 4 days a week and is comprised of exercise, education and social support. The exercise program consists of lower and upper extremity ergometry and weight training. The evaluation included 1) patient attendance; 2) exercise methods; 3) focus groups conducted by an independent facilitator and; 4) a satisfaction survey. Evaluations found that patients learned how to live with and be in control of their lung disease and had increases in their physical capacity and motivation. They found the group interaction invaluable both for learning and for social and psychological support. Patients were very satisfied with aspects of the program including staff and learning resources. Increased support such as space, staffing and finances would further strengthen the program.

RéSUMÉ

La maladie pulmonaire obstructive chronique (MPOC) est un trouble de la respiration qui se caractérise par une perte progressive de la fonction pulmonaire causée par une obstruction des voies respiratoires partiellement réversible. La réadaptation pulmonaire (RP) est un programme multidisciplinaire réunissant l’exercice et l’éducation et il est recommandé pour tous les patients souffrant de la MPOC. Plusieurs directives et normes sur la gestion de la MPOC recommandent un programme de maintien suivant la RP. Ce texte constitue un compte rendu de l’évaluation faisant suite à un programme de maintien. Le programme de la MPOC de l’Association pulmonaire d’Ottawa est avant tout un programme de maintien à long terme faisant suite à une réadaptation complète. Il offre 7 séances, 4 jours par semaine et il se compose d’exercice, d’éducation et d’appui psychologique et social. Le programme d’exercice comporte l’utilisation de poids et d’ergométrie pour les membres inférieurs et supérieurs. L’évaluation comprend 1) les soins aux patients; 2) les méthodes d’exercice; 3) les groupes de discussion menés par un animateur indépendant et 4) un sondage sur la satisfaction. Les résultats de l’évaluation indiquent que les patients apprennent à vivre avec leur maladie pulmonaire et à la surveiller et qu’ils constatent une augmentation de leur capacité physique et de leur motivation. Ils estiment que la contribution du groupe est précieuse autant pour l’apprentissage que pour le soutien social et psychologique. Les patients sont très satisfaits du programme, notamment des ressources humaines et éducatives. Des nouveaux locaux, et d’autres ressources financières et humaines permettraient de renforcer le programme.

Keywords: Chronic Obstructive Pulmonary Disease, Pulmonary Rehabilitation, Exercise, Maintenance
INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a respiratory disorder, primarily caused by smoking, characterized by a progressive loss in lung function resulting in partially reversible airway obstruction and lung hyperinflation, systemic manifestations and increasing frequency and severity in exacerbations (1-3). COPD, in Canada was the fourth leading cause of death in 2004 and negatively affects quality of life (QOL), functional status, activity levels and costs (disease management, premature mortality, disability, missed work). (4, 5)

Pulmonary rehabilitation (PR) is a multidisciplinary program that includes the integrated components of exercise training, education and self-management, nutritional therapy, psychological support and promotion for long-term maintenance (2-4). There are numerous benefits to PR including improved health-related QOL, exercise capacity, and perception of dyspnea (6). PR is a cost-effective intervention and has the ability to address all the goals of COPD management (1, 7, 8). PR is recommended for all patients with COPD, even with mild and minimal symptoms.

Upon “graduation” or completion, the benefits of PR tend to fade within 6 months (9). However when patients participate in a long-term, “post graduate” or maintenance program the benefits have been shown to be maintained for up to 18 months (10) to 3 years (11). Steinsbekk et al (11) in a prospective observational study examined a long-term PR program for 30 patients with COPD. It consisted of 32 hours of education and three weekly one-hour exercise sessions over 2 years. The program was based on self-management principles where patients placed in groups of 5 to 7. After the intervention there were statistical and clinical improvements in QOL (as measured by the St. George’s Respiratory Questionnaire (SGRQ)) and 6 minute walk test (6MWT) distance, which was maintained for 3 years. Eighty percent of patients still exercised at least 30 minutes three times a week from the end of the program to year 5. Similarly Guell et al (10) assessed the impact of a long-term rehabilitation program using a randomized control trial. They randomly assigned 60 COPD patients to receive a one-year PR program (n=30) or standard care (n=30). The one-year PR program comprised of 3 months of breathing retraining and chest physiotherapy, 3 months of daily supervised exercise, and 6 months of weekly supervised breathing exercises. The PR group had significantly better perceptions of dyspnea, 6MWT distance, day-to-day dyspnea, fatigue, and emotional function (as measured by the Chronic Respiratory Questionnaire (CRQ)) and a significant reduction in exacerbations. These effects continued with somewhat diminished magnitude in the second year of follow-up.

The studies by Steinsbekk et al (11) and Guell et al (10) showed that long-term rehabilitation programs are able to maintain improvements in outcomes for COPD patients. There have also been studies comparing follow-up or maintenance programs with standard care or a control intervention. The post PR approaches that have been previously investigated are highly variable: regular visits to the PR centre (10, 12-16), graduated discharge with decreasing visits over several months (17-20), community based programs (21), home visits by health care providers (22) and access to self-help groups (10, 23). The efficacy of these maintenance programs has also been mixed. For instance Brooks et al (19) randomly assigned 109 COPD patients to receive enhanced follow-up (EF) or conventional follow-up (CF). Subjects in the EF group received for one year, monthly two hour group sessions and follow-up phone calls by a staff member. During these interactions patients were provided encouragement and education on the different aspects of their home PR program. After the one-year follow-up, there were no differences in 6MWT distance or any domain of the CRQ between the two groups. Spencer et al (16) randomly assigned 59 COPD patients (48 completed) to a one-year post-PR program (n=24) or standard care (n=24). The intervention consisted of weekly, supervised, outpatient-based exercise plus unsupervised home exercise; standard care consisted only of unsupervised home exercise training. Although both groups maintained their QOL (via the SGRQ) and 6MWT distance over time there was no significant difference between the two groups. Ringbaek et al (20) randomized 96 COPD patients (after completing a 7 week PR program) to an 18 month maintenance program (n=55) or a control intervention (n=41). The intervention consisted of weekly supervised training the first 6 months, supervised training every second week the next 6 months, and no supervised training the last 6 months. Both groups were requested to continue unsupervised training at home. In contrast to Brooks et al (19) and Spencer et al (16) the intervention group (compared to control) had significantly better endurance shuttle walk test times at 3 and 6 months. Similarly Ries et al (18) evaluated a one-year maintenance program (after PR) in 172 COPD patients. They were randomized to receive weekly telephone calls and monthly supervised reinforcement sessions (n= 87) or standard care (n= 85). Patients receiving standard care were referred back to the patient’s primary care provider for continued medical care with a letter outlining the recommended home care rehabilitation program. After the 12 months the intervention group (compared to control) had significantly greater improvements in exercise tolerance (maximum treadmill workload and 6MWT walk distance) and overall health status ratings and a significant reduction in hospital days.

In all these maintenance or long-term approaches, continued enhancement of healthcare interventions usually involves regular contact and collaboration with health care professionals who supervise and encourage patients (10, 17, 18, 23-27). In addition, peer and social support is often key for continued participation or adherence (28). Several guidelines and standards on the management of COPD recommend some sort of maintenance program after PR (1-3). Since many approaches have been shown to be successful, it is likely the components and accessibility of a maintenance program depend on resources (venue, funding) and personnel.
The purpose of this program evaluation was to assess The Lung Association’s Ottawa COPD program, which acts primarily as a long-term maintenance program, following comprehensive PR.

METHODS

Program Description
The program offers 7 two-hour classes per week on 4 different days consisting of a structured exercise program (group format), followed by some social support time. The patients can attend the program for as long as they choose to. The fees are $50 CAD a month for those who want to attend two or more classes per week and $25 CAD a month for those who attend one class per week. A respiratory therapist meets with each patient upon entry to the program to discuss their own goals.

The exercise program offers 3 components and is individualized for each patient:
1) Stretching exercises to promote and improve flexibility.
2) Resistance training to improve muscular tonus and strength.
3) Aerobic exercise to improve aerobic capacity and cardiovascular fitness.

During each class the 3 exercise components are divided in two parts. Part 1 focuses on warm up, strengthening and some flexibility exercises for upper and lower extremities and abdominals (45 minutes to 1 hour). Part 2 is the aerobic component and consists of cycling or arm ergometry (15 minutes) and walking on treadmill (15 minutes) (Figure 1). Patient’s heart rate and oxygen saturation, while resting before the exercise and at the end of each phase of the exercise program, are monitored.

In addition to the exercise program, there is an education session monthly on a variety of topics such as understanding COPD, medications, and sleep apnea.

FIGURE 1: Four Ottawa COPD Program patients performing aerobic exercise.

Evaluation

1) Exercise Program
We examined a log collected for one year, describing patient attendance and their exercise regimen. This included descriptions of weights used, treadmill exercise (time, gradient, speed), arm ergometry and leg training (time, speed). In addition, patients were asked, at each visit, the frequency and type of exercise performed at home.

2) Focus Groups
To gain a deeper understanding of the overall impact of the PR program on patients’ lives, focus groups were conducted. To allow for greatest participation, focus groups were scheduled a number of times over a two month period. All 3 focus groups, with a total of 25 patients, were conducted by an independent researcher (JK). Each focus group was approximately 45 to 60 minutes and began by patients being asked to fill out a short demographic form which included questions about their age, respiratory disease diagnosis and age at time of diagnosis. The majority of the time in the focus groups was taken up by a discussion facilitated by JK using guiding questions. These guiding questions were in regard to the impact of the program on daily life, effects of the disease and suggestions to the health care providers and health care policy makers/funding parties. A note taker was present at each focus group to record patients’ comments and discussion. Using a generalized qualitative research approach, focus groups participants’ comments and insights were categorised into key themes by JK. These themes reflected the many different ways (physical, psychological and social) that the PR program had impacted the patients’ lives including gaining knowledge and strategies to learn to live with lung disease. The patients also provided key suggestions to improve the program.

3) Satisfaction Questionnaire
A satisfaction survey was gathered from 97 patients taking part in the program. This survey was a modified version of The Client Perspectives of Rehabilitation Services Questionnaire (CPRSQ), a publicly available, reliable and valid measure of client-centred rehabilitation that is used for discriminative and evaluative purposes (29). Two version of this questionnaire were administered depending on the whether the patient had newly entered the program (N=57) or had been attending sessions previously (N=41), the difference being one question. Table 1 provides details on the questions asked.

RESULTS

Demographics and Attendance
Patients were free to come and go to the classes as they wished therefore the number of patients who took part in the program varied. For the duration of the evaluation (November 1st 2006 to November 29th 2007) a total of 64 logs were collected from patients.

Patients taking part in the exercise program were on average (SD) 74 (9) years, comprising of approximately 65% females. Of 64 patients, 19 (30%) required supplemental oxygen during the program. The average dosage was 3 (1) lpm.
The average (SD) number of patients per session was 14 (7), the range 1 to 40. Figure 2 shows details on participant attendance per session over one year.

**TABLE 1**: Descriptions for all Exercise Methods

<table>
<thead>
<tr>
<th>Exercise Method</th>
<th>Mean (SD)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TREADMILL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade (%)</td>
<td>3.2 (3.6)</td>
<td>0.0 – 45.0</td>
</tr>
<tr>
<td>Time (min)</td>
<td>12.4 (5.8)</td>
<td>0.6 – 35.0</td>
</tr>
<tr>
<td>Top speed (mph)</td>
<td>1.9 (3.6)</td>
<td>0.1 – 45.0</td>
</tr>
<tr>
<td>O₂ saturation (%) (pre-exercise)</td>
<td>95.0 (2.7)</td>
<td>71.0 – 100.0</td>
</tr>
<tr>
<td>Heart rate (bpm) (pre-exercise)</td>
<td>86.2 (13.4)</td>
<td>35.0 – 169.0</td>
</tr>
<tr>
<td>O₂ saturation (%) (recovery)</td>
<td>94.0 (2.9)</td>
<td>75.0 – 100.0</td>
</tr>
<tr>
<td>Heart rate (bpm) (recovery)</td>
<td>97.6 (16.0)</td>
<td>32.0 – 167.0</td>
</tr>
<tr>
<td><strong>ARM ERGOMETRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (min)</td>
<td>10.4 (3.8)</td>
<td>1.0 – 55.0</td>
</tr>
<tr>
<td>Top speed (mph)</td>
<td>28.8 (6.9)</td>
<td>2.2 – 91.0</td>
</tr>
<tr>
<td>O₂ saturation (%) (pre-exercise)</td>
<td>94.3 (2.5)</td>
<td>86.0 – 99.0</td>
</tr>
<tr>
<td>Heart rate (bpm) (pre-exercise)</td>
<td>96.5 (9.7)</td>
<td>69.0 – 115.0</td>
</tr>
<tr>
<td>O₂ saturation (%) (recovery)</td>
<td>94.6 (2.2)</td>
<td>82.0 – 100.0</td>
</tr>
<tr>
<td>Heart rate (bpm) (recovery)</td>
<td>95.8 (17.0)</td>
<td>25.0 – 143.0</td>
</tr>
<tr>
<td><strong>LEG ERGOMETRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (min)</td>
<td>11.0 (4.4)</td>
<td>1.5 – 40.0</td>
</tr>
<tr>
<td>Top speed (mph)</td>
<td>31.4 (6.9)</td>
<td>2.2 – 44.0</td>
</tr>
<tr>
<td>O₂ saturation (%) (pre-exercise)</td>
<td>93.8 (3.1)</td>
<td>84.0 – 99.0</td>
</tr>
<tr>
<td>Heart rate (bpm) (pre-exercise)</td>
<td>94.9 (12.2)</td>
<td>63.0 – 116.0</td>
</tr>
<tr>
<td>O₂ saturation (%) (recovery)</td>
<td>94.1 (2.3)</td>
<td>82.0 – 100.0</td>
</tr>
<tr>
<td>Heart rate (bpm) (recovery)</td>
<td>98.5 (15.4)</td>
<td>45.0 – 143.0</td>
</tr>
<tr>
<td><strong>WEIGHTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pounds</td>
<td>4.8 (3.1)</td>
<td>1.0 – 20.0</td>
</tr>
<tr>
<td>Repetitions</td>
<td>6.2 (3.4)</td>
<td>0.5 – 25.0</td>
</tr>
</tbody>
</table>

Min=minutes; mph=miles per hour; bpm=beats per minute; SD=standard deviation.

**EXERCISE**

The treadmill was used in 56% of the sessions (N=2277 out of 4042 maximum number of sessions), with an average (SD) grade of 3.2 (3.6) %, total time of 12.4 (5.8) minutes and top speed of 1.9 (3.6) miles per hour. Arm ergometry exercise was used in 25% of the sessions (N=1024). Total time exercised was 10.4 (3.8) minutes and top speed was 28.8 (6.9) miles per hour. Leg ergometry exercise was used in 27% of the sessions (N=1078), total time of 11.0 (4.4) minutes and top speed of 31.4 (6.9) miles per hour. Weight exercise was used in 22% of the sessions (N=905) with an average weight of 4.8 (3.1) pounds and 6.2 (3.4) repetitions. Table 1 shows more details on all exercises performed.

When patients were asked if they had exercised at home since the last session, approximately 25% said “yes”: 55% of these patients exercised between 1 to 3 times; 21% greater than 4 times; 17% “daily” and; the rest indicated a “few” to “very little”. The types of activities varied widely between patients and many performed more than one type. The majority indicated “walking” as their primary form of exercise. Other types included stretches, weights, treadmill, breathing exercises, cycle, aerobics, swimming and the PR program. The average number of minutes spent on each activity session was 28.8 (29.5) minutes, with a range of 1.5 to 240 minutes. For those unable to exercise, the main reasons were fatigue (7.8%), shortness of breath (7.8%), lack of motivation (5.7%) and lack of time (5.0%).

**FOCUS GROUPS**

The sub-sample of patients who took part in the focus groups were on average 70 (13) years old, the majority (24%) married and unemployed (48%). The majority of patients had COPD (69%), while others had asthma (23%). Patients were diagnosed at the age of 59 (19) years old. The number of years they were living with respiratory disease was 16 (20) years, range 1 to 70 years.

When asked about the impact of the program on knowledge, patients stated that they learned strategies for daily activities e.g. how to control shortness of breath when going up stairs. They also were able to better problem solve and think ahead of time before doing activities. Patients learned and understood different aspects about living with their lung condition. With this knowledge they were more confident regarding their exercise, medications and interactions with physicians. Patients found the interaction with the group was a valuable learning resource.

When asked about impact of the program physically, patients reported increases in their physical capacity e.g. endurance, strength, flexibility. They were also better motivated.
to initiate and continue exercise both during the sessions and at home. Psychologically, patients found it a safe place to exercise because of the facilities, the group setting and the staff. They also felt “they were not alone”; the group understood the problems associated with lung disease (sometimes better than family). Patients enjoyed the commonality, empathy and compassion of the group and the staff. In addition the socialization was beneficial, especially for those living alone. Some considered the group like a second family.

Suggestions to improve the program included: availability of a bigger space, providing more than one staff member (for vacation and sick coverage) and financial aid for those with low incomes. Patients wanted a greater role in self-management e.g. standing medication orders. Suggestions to the policy makers and funding agencies were to increase the number of programs and accessibility, especially in under serviced areas. Patients helped advocate for this through the Local Hospital Integrated Networks (LHIN) in Ontario and via the media.

SATISFACTION SURVEY

Overall, patients were very satisfied, on average strongly agreeing or agreeing with the various aspects of the program.

TABLE 2: Satisfaction Survey Results

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean (SD) Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 My treatment needs, priorities, and goal were important to the program staff</td>
<td>1.45 (0.54)</td>
</tr>
<tr>
<td>2* I was encouraged to participate in setting my goals</td>
<td>1.55 (0.63)</td>
</tr>
<tr>
<td>3 I had difficulty getting the information I needed</td>
<td>4.04 (1.15)</td>
</tr>
<tr>
<td>4 I received the information that I needed when I needed it</td>
<td>1.62 (0.76)</td>
</tr>
<tr>
<td>5 My therapy program was explained to me in a way that I could understand</td>
<td>1.55 (0.72)</td>
</tr>
<tr>
<td>6 I knew who to contact if I had problems</td>
<td>1.48 (0.56)</td>
</tr>
<tr>
<td>7 The program staff and I discussed my progress together and made changes as necessary</td>
<td>1.82 (0.84)</td>
</tr>
<tr>
<td>8 The program staff treated me as a person instead of as just another case</td>
<td>1.35 (0.48)</td>
</tr>
<tr>
<td>9 I was treated with respect and dignity</td>
<td>1.31 (0.46)</td>
</tr>
<tr>
<td>10 My emotional needs (worries, fears, anxieties) were acknowledged and addressed</td>
<td>1.69 (0.78)</td>
</tr>
<tr>
<td>11 I felt comfortable expressing my feelings to program staff</td>
<td>1.49 (0.52)</td>
</tr>
<tr>
<td>12+ I accomplished what I expected in my rehabilitation program</td>
<td>1.51 (0.56)</td>
</tr>
</tbody>
</table>

For all questions: 1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree. Two version of this questionnaire were administered depending on the whether the patient had newly entered the program* (N=57) or had been attending session previously+ (N=41).

SD=standard deviation; N=sample size.

DISCUSSION

The COPD maintenance program through the Lung Association in Ottawa offers 7 sessions, 4 days a week and is comprised of exercise, education, psychological and social support. Evaluation of this program revealed positive outcomes. The sessions were well attended (average 14 individuals) and used a variety of modalities. Patients learned how to live with and be in control of their lung disease and had increases in their physical capacity and motivation. They found the group interaction invaluable both for learning and for social and psychological support. Patients were very satisfied with the aspects of the program including staff and learning resources. Increased support such as space, staffing and finances would further strengthen the program.

The Ottawa COPD Program includes the integrated components that comprehensive PR has: exercise training, education and self-management, psychological support and promotion for long-term maintenance. PR is recommended for all patients with COPD, even with mild or minimal symptoms. In addition, when patients participate in a maintenance program the benefits could be maintained, especially if programs involve regular contact and collaboration with health care professionals who supervise and encourage patients and; peer support (10, 17, 23-27). Despite the positive effects of PR, the availability of these programs is low. In a 2005, it was estimated that only 1.2% of people living with COPD in Canada had access to PR programs. This low availability is likely the case for maintenance programs as well. Approaches that can be used to increase accessibility to rehabilitation programs include: promotion of self-management strategies (30) and home-based programs (31), both of which have shown benefits in exercise capacity and QOL (compared to standard care or no rehabilitation (31)) and reduced hospitalizations (30). Previous studies of community based PR programs (21, 32) have shown improvements in functional exercise capacity, dyspnea, and quality of life (compared to control interventions) but further research is needed to establish the efficacy and optimal composition of these programs. Despite the paucity of evidence, this current evaluation shows The Ottawa COPD Program is a well established program and successful working example.

There were a number of limitations of this evaluation: 1) only those patients who joined and continued with the program were included. Data was not collected on those who dropped out or do not have access to the program; 2) a mixed population of patients (living with both COPD and asthma) were included.

In conclusion, the Ottawa COPD program is extremely valuable and has important impact on individual QOL and life satisfaction. This current one requires continued support, including funding and resources such as space, evolving technology, qualified staff and continuing education and training. Traditional PR programs have been provided in either a hospital or rehabilitation centre structure. This maintenance program structure could easily be replicated in other parts of Canada to provide more access to PR for people living with COPD and thus improve their QOL.
REFERENCES


The purpose of this article is to describe the use of noninvasive inspiratory and expiratory muscle aids to prevent ventilatory insufficiency and failure, and to permit the extubation and tracheostomy tube decanulation of “unweanable” patients. Noninvasive airway pressure aids can provide up to continuous ventilator support for patients with little or no vital capacity and can provide for effective cough flows for patients with severely dysfunctional expiratory muscles. An April 2010 consensus of clinicians from 20 centers in 14 countries reported over 1500 spinal muscular atrophy type 1 (SMA1), Duchenne muscular dystrophy (DMD), and amyotrophic lateral sclerosis (ALS) patients who survived using continuous ventilatory support without tracheostomy tubes. Four of the centers routinely extubated unweanable DMD patients so that none of their over 250 such patients has undergone tracheotomy. This approach is now making inroads into Canada via centers in Ottawa and Montreal.

Respiratory impairment results from either primarily lung/airways diseases, in which case pulmonary function testing can be indicated and supplemental oxygen and bronchodilators beneficial, or it results from complications of respiratory muscle impairment. The former is characterized by hypoxia in the presence of eucapnia or hypocapnia until an exacerbation causes acute respiratory failure (ARF). The latter is characterized by hypercapnia and hypoxia caused by hypoventilation or respiratory insufficiency/failure do to an ineffective cough. The former is respiratory insufficiency/failure whereas the latter may be ventilatory insufficiency/failure. Unfortunately, physicians rarely distinguish between the two, referring to both, as well as evaluating and treating both, as respiratory insufficiency/failure. This results in needless morbidity and mortality, not to mention cost and decreased quality of life. Symptomatic hypercapnic patients benefit from noninvasive positive pressure ventilation (NIV) for at least part of the day and, more often overnight. With progressive inspiratory muscle weakness, ventilator-free breathing ability is eventually lost. Airway mucus plugging due to an ineffective cough is reversible by using expiratory (cough) aids.

Ventilatory insufficiency/failure can be nocturnal only and result from diaphragm dysfunction with the patient unable to breathe when supine; it can be from total inspiratory muscle failure; it can result from inadequate central ventilatory drive, or it can result from severe obesity or chest wall restriction. Many patients with ventilatory insufficiency survive for years without ventilator use at the cost of orthopnea and increasing hypercapnia with its associated symptoms and dangers and a compensatory metabolic alkalosis that depresses central ventilatory drive. The alkalosis allows the brain to accommodate to hypercapnia without overt symptoms of acute ventilatory failure. Hypercapnic patients not using NIV,
and especially those receiving supplemental oxygen, develop increasingly severe hypercapnia that eventually results in coma from carbon dioxide narcosis and ventilatory arrest. When symptomatic, hypercapnic patients are properly treated with NIV, blood gases normalize, and symptoms and alkalosis resolve as the kidneys excrete excess bicarbonate ions. Because of the need to take bigger breaths to maintain normal PaCO$_2$ and blood pH when discontinuing NIV in the morning, dyspnea can necessitate increasing periods of daytime NIV until patients require NIV continuously. Some patients with ventilatory muscle failure and no measurable vital capacity (VC) with their respiratory muscles use only nocturnal aid and rely on glossopharyngeal breathing (GPB) to ventilate their lungs during daytime hours.

There are three respiratory muscle groups: the inspiratory muscles, expiratory (predominantly abdominal and upper chest wall) muscles for coughing, and the bulbar-innervated muscles. While the inspiratory and expiratory muscles can be completely supported such that even patients with 0 mL of VC have used NIV for over 50 years without resort to tracheostomy, there are no effective noninvasive measures to assist bulbar-innervated muscle function. Thus, the only indication for tracheostomy in an unweanable patient is the aspiration of saliva to the degree that the oxyhemoglobin saturation decreases and remains below 95%. (1) Fortunately, the only neuromuscular disease (NMD) in which this happens is in advanced bulbar amyotrophic lateral sclerosis (ALS) after patients have entirely lost the ability to speak and swallow food. Such patients develop essentially irreversible upper airway obstruction and require tracheostomy tubes to protect the airway.

**WHAT ARE PHYSICAL MEDICINE RESPIRATORY MUSCLE AIDS?**

Inspiratory and expiratory muscle aids are devices and techniques that involve the manual or mechanical application of forces to the body, or intermittent pressure changes to the airway, to assist inspiratory or expiratory muscle function. The devices that act on the body include body ventilators that create pressure changes around the thorax and abdomen. Negative pressure applied to the airway during expiration assists coughing, just as positive pressure applied to the airway during inhalation (NIV) assists the inspiratory muscles. Continuous positive airway pressure (CPAP) does not assist ventilation and is not useful for patients with primarily ventilatory impairment.

**PATIENT EVALUATION**

Patients with diminished ventilatory reserve who are able to walk commonly complain of exertional dyspnea. Eventually, morning headaches, fatigue, sleep disturbances, and hypersomnolence develop (2). For wheelchair users, symptoms may be minimal except during intercurrent respiratory infections when they complain of anxiety, inability to fall asleep, and dyspnea. Patients are observed for tachypnea, paradoxical breathing, hypophonia, nasal flaring, use of accessory respiratory musculature, cyanosis, flushing or pallor, and airway secretion congestion. Lethargy and confusion signal CO$_2$ narcosis.

Evaluation necessitates 4 items: a spirometer, peak flow meter, capnograph, and oximeter. The VC is measured in sitting and supine positions. The VC difference should be less than 7%. Since hypventilation is worse during sleep, the supine rather than sitting position VC is the most important indicator of ventilatory dysfunction. When it is greater than 20% orthopnea often indicates the need for nocturnal NIV. Patients wearing thoracolumbar bracing should have the VC measured both with the brace on and off, since a good fitting brace can increase VC - whereas a poorly fitting one can decrease it. Spirometry is also useful for monitoring progress with GPB and air stacking, that is, retention of a maximum lung volume of aid delivered by manual resuscitator or volume cycling ventilator that can be held by the glottis. The maximum volume is termed the maximum insufflation capacity (MIC). Patients who learn GPB can often air stack consecutive GPB gulps to or beyond the MIC (3). A nasal interface or lipseal can be used for air stacking when the lips are too weak for effective air stacking via the mouth (Figure 1).

**FIGURE 1** - Patient with Duchenne muscular dystrophy demonstrating air stacking via a manual resuscitator.

Cough peak flows (CPF) are measured using a peak flow meter (Access Peak Flow Meter, Healthscan Products Inc., Cedar Grove, NJ). CPF of 160 L/m are the minimum needed to cough effectively (3), and this is the best indicator for tracheostomy tube removal irrespective of remaining pulmonary function. Indeed, 40% of patients with ALS can survive despite continuous ventilator dependence using strictly noninvasive aids (1). Patients with VCs less than 1,500 ml have assisted CPF measured from a maximally stacked volume of air and with an abdominal thrust delivered simultaneously with glottic opening. (4) Coughing from a deep air stacked volume with a concomitantly applied abdominal thrust is termed a manually assisted cough (Figure 2).

For the stable patient without intrinsic pulmonary disease, arterial blood gas sampling is unnecessary. Besides the
survival without resorting to tracheotomy. Unweanable
rent chest infections; to avoid hospitalizations, and prolong
goals are to avert episodes of ARF, especially during intercur
around the clock, and to maximize CPF. The long-term
growth for children, to maintain normal alveolar ventilation
compliance and to promote normal lung and chest-wall
The intervention goals are to maintain lung and chest-wall
require nocturnal NIV to prevent pectus excavatum and pro-
infantile NMD who have paradoxical chest-wall movement
(SMA) type 1, infants with SMA type 2, and others with

While all clearly symptomatic patients with dimin-
ished lung volumes require a trial of NIV to ease symptoms,
if symptoms are questionable, nocturnal noninvasive blood
gas monitoring can be performed. The oximeter and the cap-
nograph, which measures end-tidal pCO₂, must be capable
of summarizing the data. (2) These studies are most conve-
niently performed in the home. Any questionably symptom-
atic patient with decreased VC, multiple nocturnal oxyhe-
moglobin desaturations below 95%, and elevated nocturnal
PaCO₂ should also undergo a trial of nocturnal NIV. Since, in
general, only patients improperly treated with supplemental
O2 develop CO₂ narcosis and ARF is generally caused by in-
effective cough and airway secretion management, any patient
finding that NIV use is more burdensome than symptoms of
ventilatory insufficiency is told that it is alright to discontinue
NIV and return for a re-evaluation in 3 to 6 months.

For symptomatic patients with normal VC, an unclear
pattern of oxyhemoglobin desaturation, and no apparent car-on dioxide retention, sleep disordered breathing is suspected
and a polysomnogram warranted. (6) Obesity-hypoventilation
patients are treated with nocturnal ventilatory support, as are
NMD patients, and not with CPAP. Polysomnography is not
indicated for patients with decreased VC (NMD) because it
is programmed to interpret every apnea and hypopnea as
resulting from central or obstructive events rather than from
inspiratory muscle weakness. Further, treatment of asym-
omatic NMD patients on the basis of polysomnographic
abnormalities neither prolongs life nor improves its quality.

THE INTERVENTION OBJECTIVES
The intervention goals are to maintain lung and chest-wall
compliance and to promote normal lung and chest-wall
growth for children, to maintain normal alveolar ventilation
around the clock, and to maximize CPF. The long-term
goals are to avert episodes of ARF, especially during intercur-
current chest infections; to avoid hospitalizations, and prolong
survival without resorting to tracheotomy. Unweanable

intubated and canulated patients can be extubated and
decanulated to NIV and mechanically assisted coughing
(MAC). All goals can be facilitated by evaluating, training, and
equipping patients in the outpatient setting and at home.

LONG-TERM MANAGEMENT
Goal One: Maintain pulmonary compliance, lung growth,
and chest-wall mobility

Pulmonary compliance is diminished because the patient
can not expand the lungs to predicted inspiratory capacity.
As the VC decreases, the largest breath one can take only
expands a fraction of lung volume. Like limb articulations,
regular mobilization is required to prevent chest-wall con-
tractures and lung restriction. This can only be achieved by
providing deep insufflations, air stacking, or nocturnal NIV
(7). The extent to which the MIC exceeds VC (MIC-VC)
objectively quantitated glottic, and therefore bulbar-inner-
vated muscle integrity, and correlates with the capacity to use
noninvasive aids rather than tracheostomy. (4) Patients who
can not close the glottis and, therefore, can not air stack, must
be passively insufflated using a CoughAssist™ (Respironics
International Inc., Murrysville, Pa), pressure-cycling ventilat-
or at pressures of 40 to 70 cm H₂O, or manual resuscitator
with the exhalation valve blocked. The maximum passive
insufflation volume can be termed the “Lung Insufflation
Capacity” or LIC. (8)

The primary objectives of lung expansion therapy are to
increase the VC and to maximize CPF (Figure 1), to maintain
or improve pulmonary compliance, to diminish atelectasis,
at master NIV. In 282 spirometry evaluations of NMD
patients for VC, MIC, and LIC, the authors found mean
values of 1131 ± 744 mL, 1712 ± 926 mL, and 2069 ± 867 mL,
respectively. (8) The deeper lung volumes by air stacking also
permitted patients to raise voice volume as desired.

Because any patient who can air stack is also able to use
NIV, if such a patient is intubated for respiratory failure, he
or she can more easily be extubated directly to continuous
NIV regardless of ventilator-free breathing ability (VFBA).
Exubation of patients without VFBA who are inexperienced
in NIV can result in panic, ventilator dysynchrony, asphyxia,
and, at times, reintubation.

Before patients’ VCs decrease to 70% of predicted nor-
mal, they are instructed to air stack 10 to 15 times, at least
two or three times daily usually using a manual resuscitator.
Because of the importance of air stacking, NIV is provided
via ventilators using volume rather than pressure cycling, on
assist/control mode.

Infants cannot air stack or cooperate with passive in-
sufflation therapy. All babies with spinal muscular atrophy
(SMA) type 1, infants with SMA type 2, and others with
infantile NMD who have paradoxical chest-wall movement
require nocturnal NIV to prevent pectus excavatum and pro-
mote lung growth as well as for ventilatory assistance. (9) In
addition to nocturnal aid, deep insufflations may be possible
by delivering air from a manual resuscitator via an oral-nasal

FIGURE 2 - Measurement of assisted cough flows following air
stacking to a deep lung volume and abdominal thrust/tussive
squeeze.
interface and timing the air delivery to the child's breathing. Children can become cooperative with deep insufflation therapy by 14 to 30 months of age.

**Goal Two: Maintain normal alveolar ventilation by inspiratory muscle assistance**

Although the inspiratory muscles can be assisted by applying pressures to the body, negative pressure body ventilators cause obstructive apneas, are less effective than NIV, and become increasing less effective with age and decreasing pulmonary compliance. (10) Blood gases improve dramatically when switching patients from them to NIV.

A body ventilator that continues to be useful is the intermittent abdominal pressure ventilator (IAPV) or "Exsufflation Belt" (Respironics International Inc., Murrysville, PA). It involves the intermittent inflation of an elastic air sac that is contained in a corset or belt worn beneath the patient's outer clothing (Figure 3). The sac is cyclically inflated by a positive pressure ventilator. Bladder inflation moves the diaphragm upward to assist in expiration. During bladder deflation, gravity causes the abdominal contents and diaphragm to return to the resting position and inspiration occurs passively. A trunk angle of 30 degrees or more from the horizontal is necessary for it to be effective. If the patient has any inspiratory capacity or is capable of GPB, he or she can add volumes necessary for it to be effective. If the patient has any inspiratory muscle assistance.

**FIGURE 3 - A 44 year old with Duchenne muscular dystrophy using an intermittent abdominal pressure ventilator (Exsufflation Belt" (Respironics International Inc., Murrysville, PA) during daytime hours and insufflation nightly for 19 years. The air bladder inside the girdle is connected to the ventilator circuit (seen here), then the girdle is placed under the clothes and over the patient's abdomen.**

**NONINVASIVE INTERMITTENT POSITIVE PRESSURE VENTILATION (NIV)**

NIV can be noninvasively delivered via lipseals, nasal, and oral-nasal interfaces for nocturnal ventilatory support. Mouthpiece and nasal IPPV are open systems that require the user to rely on central nervous system reflexes to prevent excessive insufflation leakage during sleep (2, 12), thus, supplemental oxygen and sedatives can render NIV ineffective. NIV should be introduced in the clinic or home setting.

There are numerous commercially available nasal interfaces (CPAP masks). Several should be tried and the patient should be encouraged to alternate their use. Excessive insufflation leakage can be avoided by switching to the use of a closed noninvasive system such as using lipseal-nasal prong systems. Such interfaces deliver air via mouth and nose during sleep and require minimal strap pressure. This optimizes skin comfort and minimizes air (insufflation) leakage. Excessive leakage is also prevented by sustaining ventilatory drive by maintaining normal daytime CO$_2$ and avoiding supplemental O$_2$ and sedatives.

NIV via a 15 mm angled mouth piece is the most important method of daytime ventilatory support. Some patients keep the 15 mm angled mouthpiece between their teeth all day. (13) Most have the mouthpiece held near the mouth. A metal clamp attached to a wheelchair can be used for this purpose, or the mouthpiece can be fixed onto motorized wheel chair controls—most often, sip and puff, chin, or tongue controls (Figure 4). The ventilator is set for large tidal volumes, often 8000 to 1500 mL. The patient grabs the mouthpiece with his mouth and supplements or substitutes for inadequate autonomous breath volumes. The patient varies the volume of air taken from ventilator cycle to ventilator cycle and breath to breath to vary speech volume and cough flows as well as to air stack to fully expand the lungs. Some neck movement and lip function are needed to grab the mouth piece and use it without leaking air. The soft palate must move posteriocaudally to seal off the nasopharynx. In addition, the patient must open the glottis and vocal cords, dilate the hypopharynx, and maintain airway patency. These normally reflex movements may require a few minutes to relearn for patients who have been receiving ventilation via a tracheostomy tube. (14)

Nasal NIV is most practical for nocturnal use but it is also indicated for infants and for those who can not grab or retain a mouth piece because of oral muscle weakness, inadequate jaw opening, or insufficient neck movement. Continuous nasal NIV is, nevertheless, a viable and desirable alternative to tracheostomy. (2) Nasal NIV users learn to close their mouths or seal off the oropharynx with their soft palates and tongues to prevent oral insufflation leakage.

Suboptimal humidification dries out and irritates nasal mucous membranes, causes sore throat, and results in vasodilation and nasal congestion. Increased airflow resistance to 8 cm H$_2$O can be caused by the loss of humidity that is due to unidirectional airflow with expiration via the mouth during nasal CPAP or NIV. (15) This can be reduced by warming the inspired air to body temperature and humidifying it.
Mean MIC was 1647.6 mL, and although CPFs were 2.3 L/s stack, the mean VC in the sitting position was 996.9 mL, the assisted (4) in 364 evaluations of our NMD patients able to air sec were obtained by comparison with 2.5 ± 2.0 L/sec unas lung volumes by air stacking, assisted CPF of 4.3 ± 1.7 L/

Mechanically assisted coughing (MAC) is the combination of the use of mechanical insufflation-exsufflation (CoughAssistTM) with an exsufflation-timed abdominal thrust. Deep insufflations followed immediately by deep exsufflations at pressures of 40 to –40 cm H2O are usually the most effective and preferred. MAC can be provided via an oral-nasal mask, a simple mouthpiece, or via a translaryngeal or tracheostomy tube. When delivered via the latter, the cuff, when present, should be inflated. The CoughAssistTM can be manually or automatically cycled. Manual cycling facilitates caregiver-patient coordination of inspiration and expiration with insufflation and exsufflation, but it requires hands to deliver an abdominal thrust, to hold the mask on the patient, and to cycle the machine.

One treatment consists of about five cycles of MAC followed by a short period of normal breathing or ventilator use to avoid hyperventilation. Insufflation and exsufflation times are adjusted to provide maximum chest expansion and rapid lung emptying. In general, 2 to 4 seconds are required. Treatment continues until no further secretions are expelled and secretion related oxyhemoglobin desaturations are reversed. Use can be required as frequently as every 30 minutes around the clock during chest infections.

The use of mechanical insufflation-exsufflation (MI-E) via the upper airway can be effective for children as young as 11 months of age. Patients this young can become accustomed to MI-E and permit its effective use by not crying or closing the glottis. Between 2.5 and 5 years of age, most children become able to cooperate and cough on queue. Exsufflation-timed abdominal thrusts are also used for infants.

Whether via the upper airway or via indwelling airway tubes, routine airway suctioning misses the left main stem bronchus about 90% of the time. (17) MAC provides the same exsufflation flows in both left and right airways without the discomfort or airway trauma of tracheal suctioning. Patients prefer MAC to suctioning for comfort and effectiveness, and they find it less tiring. (18) Deep suctioning, whether via airway tube or via the upper airway can be effective for children as young as 11 months of age. Patients this young can become accustomed to MI-E and permit its effective use by not crying or closing the glottis. Between 2.5 and 5 years of age, most children become able to cooperate and cough on queue. Exsufflation-timed abdominal thrusts are also used for infants.

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VC, pulmonary flow rates, and SpO2 when abnormal improve immediately with clearing of airway secretions and mucus by MI-E. (19) An increase in VC of 15% to 42% was noted immediately following treatment in 67 patients with “obstructive dyspnea,” and a 55% increase in VC was noted following MI-E in patients with neuromuscular conditions (20). We have observed 15% to 400% (200 to 800 mL) improvements in VC and normalization of SpO2 as MI-E eliminates airway mucus for ventilator-assisted NMD patients with chest infections. (21)

**Goal Three:** Assist expiratory muscles to augment cough flows

Manually assisted coughing is the use of air stacking for any patient with less than 1500 ml of VC to precede an abdominal thrust timed to glottic opening. With the higher lung volumes by air stacking, assisted CPF of 4.3 ± 1.7 L/sec were obtained by comparison with 2.5 ± 2.0 L/sec unassisted. (4) In 364 evaluations of our NMD patients able to air stack, the mean VC in the sitting position was 996.9 mL, the mean MIC was 1647.6 mL, and although CPFs were 2.3 L/s (less than 2.7 L/s or the minimum needed to eliminate airway secretions) mean assisted CPF were 3.9 L/s. This is the difference between coughing effectively to prevent pneumonia and ARF or not. (16) The inability to generate 160 L/m of assisted CPF despite having a VC or MIC greater than 1 L indicates upper-airway obstruction often due to severe bulbar-innervated muscle dysfunction and should be evaluated by laryngoscopy and reversible lesions corrected surgically.

Abdominal distention tends to occur sporadically in NIV users. The air usually passes as flatus once the patient is mobilized in the morning. When severe, however, it can increase ventilator dependence and necessitate a rectal tube to decompress the colon or a nasogastric or gastrostomy tube to burp out the air.

Despite aggressive lung mobilization and expansion three times daily, often to over 60 cm H2O pressures and along with NIV support for over 50 years in many cases, we have had one case of pneumothorax in over 1000 NIV users. Although often described as a complication or limiting factor for NIV, secretion encumbrance most often results from failure to use MAC.

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Of the three muscle groups required for effective coughing, MI-E can only take the place of the inspiratory and expiratory muscles. Thus, it cannot be used to avert tracheotomy very long if bulbar-innervated muscle function is inadequate to prevent airway collapse and continuous saliva aspiration as often becomes the case in advanced bulbar ALS. On the other hand, patients with completely intact bulbar muscle function, such as most ventilator users with traumatic tetraplegia, can usually air stack to volumes of 3 L or more, and, unless very scoliotic or obese, a properly delivered abdominal thrust can result in assisted CPF of 6 to 9 L/s. These flows should be more than adequate to clear the airways and prevent pneumonia and ARF without need for MAC. Thus, the patients who benefit most from MAC have moderately impaired bulbar muscle function that limits assisted CPF to less than 300 L/m. This is typical of most non-ALS NMD patients, especially those with Duchenne muscular dystrophy (DMD) who benefit greatly from MAC. (16) Patients with respiratory muscle weakness complicated by scoliosis and inability to capture the asymmetric diaphragm by abdominal thrusting also greatly benefit from MI-E.

GLOSSOPHARYNGEAL BREATHING

Both inspiratory and, indirectly, expiratory muscle function can be assisted by GPB (22). GPB can provide an individual with weak inspiratory muscles and no VC or breathing tolerance with normal alveolar ventilation when not using a ventilator or in the event of sudden ventilator failure day or night. (22, 23) The technique involves the use of the glottis to add to an inspiratory effort by pistoning (gulping) boluses of air into the lungs. The glottis closes with each “gulp.” One breath usually consists of 6 to 9 gulps of 40 to 200 mL each (Figure 5). During the training period, the efficiency of GPB can be monitored by spirometrically measuring the milliliters of air per gulp, gulps per breath, and breaths per minute. A training manual, (24) and numerous videos are available (25), the best of which was produced in 1999. (26)

![Figure 5](image)

Although severe oropharyngeal muscle weakness can limit the usefulness of GPB, we have managed 13 DMD ventilator users who had no breathing tolerance other than by GPB (27). Approximately 60% of ventilator users with no autonomous ability to breathe and good bulbar muscle function can use GPB and discontinue ventilator use for minutes to up to all day. (22, 28) GPB is rarely useful in the presence of an indwelling tracheostomy tube. The safety and versatility afforded by GPB are additional reasons to eliminate tracheotomy in favor of noninvasive aids.

Because of their generally intact bulbar musculature, high level spinal cord injury (SCI) patients are ideal candidates to master GPB for ventilator-free breathing and be decannulated to NIV. In some centers, these patients are decannulated to free them from the fear of ventilator failure or accidental ventilator disconnection (Table 1). (22, 28)

OXIMETRY MONITORING AND FEEDBACK PROTOCOL

For a hypercapnic patient with desaturation due to chronic alveolar hypoventilation or the patient being weaned from tracheostomy ventilation, introduction to and use of mouthpiece or nasal NIV is facilitated by oximetry feedback. A SpO₂ alarm set at 94% signals the patient to normal SpO₂ over 94% all day. (16) When no longer possible to achieve this by unassisted breathing, it is done by mouth piece or nasal NIV. With time, the patient requires increasing periods of NIV to maintain normal SpO₂. In this manner, central ventilatory drive can be reset.

Continuous SpO₂ feedback is especially important during respiratory tract infections. The cough of infants and small children who can never sit is inadequate to prevent chest cold–triggered pneumonia and ARF. The patients use MAC for any dip in SpO₂ below 95%. When using NIV continuously, such dips are usually due to bronchial mucous plugging, and if not quickly cleared, atelectasis and pneumonia can quickly result. Thus, patients are instructed to use NIV and MAC to maintain normal SpO₂ to avert pneumonia, ARF, and hospitalization. For adults with infrequent chest colds, rapid access to MAC may be all that is necessary.

INVASIVE VENTILATORY SUPPORT

The use of noninvasive aids can be contraindicated by the presence of: depressed cognitive function, orthopedic conditions interfering with noninvasive interface use, pulmonary disease necessitating high FiO₂, or uncontrolled seizures or substance abuse. (29) Also, the presence of a nasogastric tube can hamper the fitting of a nasal interface and the use of mouthpiece or nasal NIV by interfering with both soft palate closure of the pharynx and seal at the nose. Although tracheostomy ventilation can extend survival for NMD patients (30), morbidity and mortality outcomes are not as favorable as by noninvasive approaches. (31, 32) Tracheotomy is indicated for severe bulbar ALS patients (1), rarely if ever for DMD and SMA patients except for the occasional SMA type 1 patient. (33) Patients with DMD, even those who are
continuously ventilator dependent on noninvasive NIV, can avoid hospitalizations and pulmonary morbidity and mortality for decades and tracheotomy indefinitely when properly managed by using respiratory muscle aids. (16)

**LONG-TERM OUTCOMES**

SMA type 1 – We reported 17 SMA-1 patients with ventilation via tracheostomy tubes, mean age 78.2 (range 65–179) months, 25 of 27 lost all autonomous breathing ability immediately upon tracheotomy. None of the 21 who had not developed the ability to verbalize before undergoing tracheotomy did so after tracheotomy. On the other hand, 72 SMA-1 patients using NIV are alive at mean age 86.1 (range 13–196) months; 13 died at 52.3 (range 13–111) months. Sixty-seven of the 75 could communicate verbally. Fifteen SMA-1 patients are now over age 10 and 6 over age 15 without tracheostomy tubes and despite requiring continuous NIV in most cases. (33) Others have also reported continuous NIV dependence for patients with SMA type 1 (Figures 6, 7). (34)

DMD - 101 of our nocturnal-only NIV users eventually became continuously NIV dependent for 7.4±6.1 years to 30.1±6.1 years of age with 56 patients still alive. Twenty-six of the 101 became continuously dependent without requiring hospitalization. Eight continuous tracheostomy ventilation users were decanulated to noninvasive NIV. Thirty-one consecutive “unweanable” intubated patients were extubated to NIV/MAC. Seven of our DMD patients have lived to over age 40 including four who have required NIV continuously for 28, 19, 21, and 24 years to ages 41, 44, 48, and 47. Others have also reported prolongation of life for DMD by continuous NIV. (35)

ALS – Of 176 of our ALS patients using nocturnal NIV, 109 or 42% of all went on to require continuous NIV for about 10 months before their SpO2 baseline decreased below 95% because of saliva aspiration due to bulbar-innervated muscle impairment. At the 69th Congress of the Mexican Society of Respirology and Thoracic Surgeons, 20 centers from 14 countries presented data on over 1500 SMA1, DMD, and ALS patients who required continuous ventilatory support without tracheostomy tubes. Four of the centers routinely extubated unweanable DMD patients so that none of their over 250 continuously ventilator dependent or any other patients has undergone tracheotomy.

**FOR EXTUBATION OF UNWEANABLE PATIENTS**

NMD-specific extubation criteria and a new extubation protocol were developed Table 2. Once meeting the criteria, oro or nasogastric tube was removed to facilitate post-extubation nasal NIV. The patient was then extubated directly to NIV on assist/control 800 to 1500 ml, rate 10-14/min in ambient air. The NIV was provided via a combination of nasal, oro-nasal, and mouth piece interfaces. Assisted CPF, CPF obtained by abdominal thrust following air stacking, were measured within 3 hours as the patient received full volume-cycled NIV support. Patients kept 15 mm angled mouth pieces accessible (Figure 4) and weaned themselves.
Table 2. Extubation Criteria for Unweanable Ventilator Dependent Patients

- Afebrile and normal white blood cell count
- PaCO₂, 40 mm Hg or less at peak inspiratory pressures less than 30 cm H₂O on full ventilatory support and normal breathing rate, as needed
- Oxyhemoglobin saturation (SpO₂) ≥ 95% for 12 hours or more in ambient air
- All oxyhemoglobin desaturations below 95% reversed by mechanically assisted coughing and suctioning via translaryngeal tube
- Fully alert and cooperative, receiving no sedative medications
- Chest radiograph abnormalities cleared or clearing
- Air leakage via upper airway sufficient for vocalization upon cuff deflation

when possible, by taking fewer and fewer intermittent positive pressure ventilations as tolerated. Diurnal nasal NIV was used for those who could not secure the mouth piece. They used nasal or oronasal interfaces for night time ventilation. For episodes of SpO₂ <95%, ventilator positive inspiratory pressure (PIP), interface or tubing air leakage, CO₂ retention, ventilator settings, and MAC were considered. Patients were then taught air stacking and manually assisted coughing. Then assisted CPF were measured.

The therapists, nurses, and in particular, the family and personal care attendants provided MAC via oro-nasal interfaces up to every 30 min until SpO₂ no longer dipped below 95% and the patients felt clear of secretions. In 7 cases, post-extubation oral intake was considered unsafe so open modified Stamm gastrostomies were performed under local anesthesia using NIV without complication.

Data were reported on 157 consecutive “unweanable” patients, 25 with SMA, 20 with DMD, 16 with ALS, 51 with other NMDs, 17 with spinal cord injury, and 11 with polio. Eighty-three who refused tracheostomies were transferred from other hospitals. They could not pass spontaneous breathing trials before or after extubation. Once SpO₂ was maintained ≥95% in ambient air they were extubated to continuous NIV and aggressive MAC. Extubation success was defined as not requiring re-intubation during the hospitalization. Before hospitalization 96 (61%) patients had no experience with NIV, 41 (26%) used it part-time, and 20 (13%) were continuously NIV dependent. First attempt protocol extubation success rate was 95% (149 patients). All 98 extubation attempts on patients with assisted CPF ≥ 160 L/m were successful. Six of 8 patients who initially failed extubation succeeded on subsequent attempts, so only two bular ALS patients with no measurable assisted CPF underwent tracheostomy. (36)

FOR DECANULATION OF UNWEANABLE PATIENTS

In 1996 we reported the decanulation of 50 unweanable patients with neuromuscular weakness. (3) Earlier, in 1990 and 1991 we and others reported the routine decanulation of high level traumatic spinal cord injured patients to NIV. (23,28) The principles of decanulating unweanable are essentially the same as those for extubation. Any ventilator dependent patient whose bulbar-innervated musculature is adequate such that saliva aspiration does not cause a continuous decrease in baseline SpO₂ is a candidate for decanulation to NIV. Patients with tracheostomy tubes who had no VFBA with VCs of 250 ml or greater invariably developed VFBA following decanulation. Most weaned to nocturnal-only NIV within 3 weeks of decanulation. Tube removal also facilitated speech and swallowing. All decanulated patients preferred NIV to tracheostomy ventilation for convenience, speech, swallowing, cosmesis, comfort, safety, and preferred it overall. (37)

CONCLUSION

A simple evaluation designed to assess a patient’s respiratory muscle function rather than a full battery of pulmonary function tests designed for obstructive/intrinsic lung disease, and the application of pressures to the body and airways to support inspiratory and expiratory muscle function rather than supplemental oxygen therapy and bronchodilators can permit many progressively weakening patients to avoid ARF. Those who do develop ARF, are intubated, and can not pass spontaneous breathing trials can, nevertheless, be almost invariably extubated to full-setting NIV and MAC and, thereby, avert tracheotomy provided that glottic function is sufficient to avoid secretion aspiration to the extent that baseline SpO₂ remains below 95%. Thus, an entirely different evaluation and treatment paradigm is required for the optimal and humane management of patients who have primarily respiratory muscle weakness rather than lung disease. While this has been done for over 12 years by Dr. Doug McKim at Ottawa Hospital, (38,39) and unweanable ventilator dependent children with spinal muscular atrophy and less than 15% of predicted normal VC are being extubated to NIV at St. Justine Children’s Hospital in Montreal, there is no evidence that this paradigm is being employed anywhere else in Canada.

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Design and Implementation of an Innovative ‘C4 Program’: Competency Assessment, Communication, Continuous Learning and Career Planning for Respiratory Therapists at Vancouver General Hospital

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ABSTRACT
Standardized performance evaluation is an important part of ensuring maintenance of competency in an unregulated province. Evolving respiratory technology and practices, shifting organizational hierarchies, and changes in program managed care further contribute to a need for routine performance appraisals. An innovative ‘C4 program’ was developed to combine components of competency assessment, individualized staff communication meetings, opportunities for continuous learning, and career planning for respiratory therapists at one Vancouver hospital. This program meets its objectives to support professional development, standardize and track levels of competency, identify learning needs, and create a positive work environment for staff.

RÉSUMÉ
L’évaluation standardisée du rendement constitue une partie importante du maintien des compétences dans une province non réglementée. L’évolution de la technologie et des pratiques de thérapie respiratoire, les mouvements de la direction des organismes et les modifications des programmes de soins renforcent aussi la nécessité de mener des évaluations régulières du rendement. Un nouveau programme « 4C » prônant l’évaluation des compétences, les réunions des communications avec le personnel, le perfectionnement continu et la planification de la carrière en thérapie respiratoire vient d’être mis en place dans un hôpital de Vancouver. Le programme répond aux objectifs d’appui au perfectionnement professionnel, d’uniformisation et de suivi des compétences, de recensement des besoins d’apprentissage et de création d’un milieu de travail positif.

Keywords: Performance appraisal, staff development, career mobility, personnel loyalty, program development

RATIONALE
Within the context of respiratory therapists working in the unregulated province of British Columbia, standardized performance evaluation becomes crucial to ensure patient safety. Without a regulatory college in place, continuing education credits are not required and new graduates have up to four years after graduation to successfully complete the Canadian Board of Respiratory Care exam. Competencies necessary for working in a large acute care hospital are generally over and above those required for entry-level practice, and most therapists require a comprehensive orientation process prior to working independently with equipment specific to their employment site.

The professional discipline of respiratory therapy involves use of continually changing technical equipment and practices. Fiscal restraints in public health care often mean practice and education support for the front-line clinician is stretched thin. With the integration of new equipment and patient care guidelines, maintenance of competency becomes equally important for the therapist with 20 years experience as it is with the new graduate.

In the cyclical nature of health workforce shortages, employee retention is a focus for any employer. Retention programs for other health care disciplines have identified autonomy, communication and recognition as key components for organizational commitment (1). Positive communication with department leaders fosters a culture of mutual trust (2), a valuable contributor to employee loyalty. In a synthesis of employee motivation theories, Ramlall (3) isolated professional development, recognition of effort, and work environment as some of the critical factors contributing to staff retention. Assisting employees in career planning is an additional strategy that can provide succession planning and contribute to organizational success (4).

Barriers to the implementation of an effective performance evaluation process include the restraints of a unionized environment and shifts to program managed health care,
where union-excluded managers may be of dissimilar professional backgrounds. Quality improvement projects are often mandated to be cost-neutral to maintain fiscal responsibility, and professional accountability may be fractured to several different leaders within complex organizational hierarchies. It is within these constraints that we sought to develop a value-laden program to ensure competency, positively influence staff retention, and create a favorable work environment to support respiratory therapy employees at the largest hospital in British Columbia (BC).

BACKGROUND

Vancouver General Hospital (VGH) is a 900+ bed adult tertiary-level care centre and teaching facility within the Vancouver Coastal Health (VCH) authority, serving 25% of the population of BC. The centralized respiratory therapy (RT) department provides 24-hour service to the intensive care unit, cardiac surgery unit, emergency department and all wards. RTs respond with code blue and critical care outreach teams. Support structure for the department includes a ‘respiratory leadership team’: RT clinical educator, professional practice leader, shift charge therapist, daily operations coordinator, and a patient services manager with a nursing background. Twelve therapists work 12-hour day and night shifts, supplied by a staff of 70 regular employees, 63% of whom have less than 5 years of work experience.

Performance appraisals in the department were historically not routine. There were annual skills evaluation sessions, but these were voluntary and not well attended. There were no formal forums for individual communications with the respiratory leadership team, and the union did not support performance evaluations by included employees; instead, the excluded manager was encouraged to provide semi-annual ‘continuous communication’ sessions to engage staff. The clinical educator provided responsive education when safety issues or knowledge gaps became apparent. Therapists indicated they wanted feedback on their performance, with some senior staff members noting they had received only one performance evaluation in 20 years of service. This article describes the development and use of an innovative ‘C4 program’ to meet this need.

Program Development and Description

The C4 program integrates components of competency assessment, communication, continuous learning and career planning for respiratory therapists (see figure 1). The development and description of each component is described below.
CAREER PLANNING
The latter half of the communication meeting is dedicated to career planning. This program coincided with a new career laddering and succession planning (CLaSP) initiative for allied health professionals in VCH, and we were able to tap into an existing framework that provides a career self-assessment survey, personal development tools, education resources and funding, workplace experience opportunities, communities of interest, and mentorship. Employees are given encouragement and support to pursue their professional development goals. This has been mutually beneficial for the department as therapists have volunteered to provide interdisciplinary education workshops, led project work, participated in research, or shared knowledge gained from conferences or courses.

CONTINUOUS LEARNING
After the communication meeting, the employee is given a copy of the competency assessment for self-directed review and individual skills are indicated for follow-up with the clinical educator. Competency assessment scores from each skill are entered into a department database. This database has become an invaluable tool and creative uses are still being identified. Some of these include:

• competency ratings can be averaged for an employee across all skills and domains, assisting the educator to identify annual trends and learning needs
• competency averages can be sorted by seniority to determine overall trends as department demographics shift
• competency averages for skills can be sorted by employee shift line, assisting the charge therapists to identify practices or equipment to review with groups during a shift
• trends over years can be determined by domain or individual skill, showing rate of knowledge uptake with new equipment or practices and justifying educational dollars or need for specific training programs
• agenda items for education days can be set using department competency averages for each skill or domain
• department ‘super-users’ can be identified to lead practice for others

EVALUATION
Formative program evaluation is through informal stakeholder feedback mechanisms. The competency assessment document is frequently updated by the practice leader when changes are identified. Modifications were made soon after program initiation when employees identified that the competence framework should be inclusive of simulation. Staff felt they had attained competency in some infrequently-used skills after practicing on a high-fidelity human patient simulator, without having performed these skills on a real patient. In response, the first three stages of competency were modified to include simulated performance. It was thought that the stage four ‘proficient’ and stage five ‘expert’ levels would be reserved for performance in a real clinical environment to reflect critical thinking in complex scenarios. Communication meeting feedback is evaluated by asking employees whether the discussion was useful to guide professional development and clinical practice.

DISCUSSION
The C4 program has been well received by staff, and has proven to be useful to support respiratory therapists and address competency levels. The model has been shared across disciplines and has been adapted for use within other health authorities in BC. Further components may be added in the future, including the development and maintenance of a professional portfolio. The program was an entirely cost-neutral endeavor. The scheduling of the communication meetings is challenging during peak vacation periods, but staggering dates throughout the year and strong stakeholder commitment has kept this process manageable. The program is adaptable and can transition into a more formal model when respiratory therapists in BC become a regulated profession. This program has allowed this department to ensure safe and competent care is delivered to patients by engaged and confident respiratory therapy practitioners.

REFERENCES
After graduating in 2003 from the University of Manitoba, my adventures of being an RRT went from working at the Health Sciences Centre in cold Winnipeg, Manitoba to the land down under working as a respiratory scientist at a pulmonary function lab in warm Gold Coast, Australia.

Five years later, two kids and back in my hometown of Winnipeg, I’ve decided to take on another exciting challenge by becoming the first registered respiratory therapist in Manitoba to become certified as an ophthalmic sedation practitioner (OSP).

After undergoing an intense training program with the Winnipeg Regional Health Authority and the University of Manitoba Department of Anesthesia, I was hired to work in the dynamic Eye Care Centre of Excellence at Misericordia Health Centre which is the largest comprehensive surgical and treatment program in Western Canada.

Ophthalmic sedation practitioner positions in Winnipeg have traditionally been taken up by nurses although the education requirements allow for graduates of an approved Allied Health Program or approved School of Nursing background. Under the supervision of the anesthesiologist, an ophthalmic sedation practitioner is responsible for performing selective pre operative assessment, anesthesia monitoring of physiological patient variables, administration of sedative and analgesic drugs used to establish up to a moderate level of sedation, rescue of patients who exhibit adverse consequences of a deeper than intended level of sedation and patient transport. Responsibilities include:

- Reviews pre-anesthetic patient history and physical, pre-operative consults and lab data
- Identifies relevant pre-existing medical, airway, and ophthalmic conditions which may affect the patient’s suitability for the planned surgical and anesthetic procedure
- Establishes peripheral IV access as required
- Administers oral preoperative sedation as required
- Sets up, calibrates, maintains and troubleshoots anesthesia machines, physiologic monitors and O2 delivery devices used in anesthesia and resuscitation
- Provides airway management including O2 therapy, bag/mask ventilation, jaw thrust, chin lift, nasal/oral airway insertion and suctioning as required
- Initiates and utilizes multi parameter monitoring of patients prior to, during and after the surgical procedure

To qualify as an OSP you must also have:

- Minimum of one year experience in Critical Care, OR environment, or Emergency in the past five years
- Certification in BLS required, ACLS preferred
- Experience in peripheral IV insertion
- Demonstrates effective organizational (task management), interpersonal (team working), critical thinking/problem solving (situational awareness and decision making)
- Superior clinical monitoring skills characterized by watchfulness, vigilance, and attention to detail
- Communicates perioperative information in a concise, clear, orderly and effective manner, orally and in writing
- Exhibits patience, understanding and compassion when working with the elderly population
- Exudes a calm, quiet, confident demeanor

Having come from a respiratory therapy background, I was well versed when it came to reviewing airway management and basic life support training. I experienced a steeper learning curve when it came to the proper methods of administering sedative and analgesic drugs intravenously. Luckily I had well experienced and vigilant anesthetic clinical assistants to guide and support me throughout my training.

My day usually starts off at 7AM where I check to see what slate I’m in, which Ophthalmologist and OR nurses I’ll be working with and what operating room we’ll be in. I then setup my anesthetic cart with my emergency drugs, airway management tools/intubation tray, and IVs. I also am required to do a daily ventilator check to make sure the anesthetic ventilator works in case of an emergency intubation.

I then see my first patient to start their IV while explaining what to expect during the procedure, reviewing their medical history and trying to reassure them by answering any questions. I’m learning it takes considerable skill in order to get the answers you are looking for when it comes to determining whether a patient is fit for surgery that day.
The two most common medical conditions we come across with patients are hypertension and diabetes. The medications patients take to manage their conditions can affect which sedative drugs we will consider giving for the procedure. It’s always an “educated guess” to determine how a patient will react on the OR table to the type and amount of drugs we give. Our goal as OSPs is patient comfort and safety, meaning we strive to keep patients’ comfortable as well as making sure they stay still and calm for the surgeon. It’s an exciting yet challenging experience in trying to achieve that perfect level of sedation as each patient can react differently every time. Once surgery is finished (an average of 30 minutes depending on the surgeon) I help transport the patient back to recovery.

The Winnipeg Health Region’s Eye Care Centre of Excellence at Misericordia Health Centre is home to an ophthalmology program that includes 14 in-patient beds and is the largest comprehensive surgical and treatment centre in western Canada. In addition, the centre includes a remote screening program for northern communities and the Lions Eye Bank. The centre assesses and treats about 24,000 patients annually, and additionally performs 8,100 eye surgeries, including 500 on an emergency basis. It has 24 surgical ophthalmologists on staff — many with sub-specialty training — serving Manitoba, Northwest Ontario, the Territories and Nunavut. The centre is a leader in cataract and retinal detachment procedures, and treatment for glaucoma and corneal diseases.

I’m looking forward to the redevelopment and construction of the new facility for the Eye Care Centre of Excellence slated for 2012. I encourage other respiratory therapists to go beyond your comfort levels and try different career paths that RRTs are very capable of achieving. Our vast training will only serve to push our profession forward and show the different opportunities there are when it comes to being a respiratory therapist.

My role as an OSP is very different than any other position I have taken as a respiratory therapist, yet all the skills needed to become an RT are well utilized as an OSP. I’m currently working two days a week as an OSP...my other part time job is at the Sleep Disorder Centre also at the Misericordia where I help set up patients on Bipap machines etc......but that’s a whole other story....until next time!!
ABSTRACT
Pulmonary surfactant covers our lung epithelial, allowing normal tidal breathing at the air/water interface. Initially, surfactant abnormalities were found in respiratory distress syndrome (RDS); later on, changes in the surfactant system were also demonstrated in acute respiratory distress syndrome (ARDS)

In neonates, Fujiwara et al. in 1980 reported that exogenous surfactant therapy reduced mortality and morbidity. And surfactant replacement therapy is now well established in the management of RDS, and represents standard care for neonates requiring mechanical ventilation. In Acute Lung Injury/Acute Respiratory Distress Syndrome (ALI/ARDS) similar dysfunction of the pulmonary surfactant system are observed. This has resulted in several trials of surfactant therapy in adults with ARDS. No effect of exogenous surfactant has been shown on survival in phase III studies in adult patients, but a phase III study performed on pediatric population did show beneficial effects of surfactant on oxygenation and survival.

However, due to the results of the randomized controlled trials performed so far, exogenous surfactant is not recommended for routine use in patients with ALI/ARDS. But natural surfactants are standard of care in pre-term babies at risk for RDS.

In the current manuscript we will discuss the rationale behind surfactant therapy, outcome of trials, and try to explain why current trials have failed to show efficacy.

Learning objective
At the completion of this activity, participants will:
• Understand the role of surfactant in the lung
• Understand the differences between natural and synthetic surfactants
• Understand why surfactant therapy is considered as a therapy for ARDS/ALI
• Understand that surfactant therapy is only used for neonatal RDS

RÉSUMÉ
Le surfactant pulmonaire couvre l’ épithélium du poumon, ce qui permet la respiration cyclique de l’ interface air/eau. Les anomalies du surfactant ont d’ abord été relevées dans les cas de syndromes de détresse respiratoire (SDR); par la suite, des modifications du système de surfactant ont aussi été relevées en présence du syndrome de détresse respiratoire aigué (SDRA). Fujiwara et al. ont signalé en 1980 que le traitement par surfactant exogène réduisait la mortalité et la morbidité chez les nouveau nés. La thérapie par remplacement de surfactant est maintenant bien acceptée pour le soin du SDR et il constitue la norme pour les nouveaux nés qui ont besoin de ventilation mécanique. On observe un mauvais fonctionnement semblable du système de surfactant pulmonaire dans les cas de lésion pulmonaire aiguë (LPA) et de syndrome de détresse respiratoire aigué (SDRA). Cette constatation a donné lieu à plusieurs essais de traitement par le surfactant chez les adultes présentant un SDRA. Les effets du surfactant sur la survie d’adultes dans des études de phases III n’ont pas été démontrés, mais une étude de phase III effectuée auprès d’une population pédiatrique a démontré les effets bénéfiques du surfactant sur l’oxygénation et la survie.

Cependant, étant donné les résultats des essais cliniques comparatifs aléatoires effectués jusqu’ à maintenant, le surfactant exogène n’est pas normalement recommandé pour les patients atteints de LPA ou de SDRA. Par contre, les surfactants naturels constituent la norme des soins des bébés prématurés à risque de SDR.

Ce texte aborde la justification de la thérapie par surfactant, les résultats des essais, et tente d’expliquer pourquoi les essais courants n’ont pas démontré d’efficacité.
INTRODUCTION

Lungs have evolved independently on several occasions over the past 300 million years such that all major vertebrate groups have members with lungs (Daniels & Orgeig, 2003, p151). However, lungs differ considerably in structure, embryological origin, and function between vertebrate groups. Generally, in non-mammals, lungs are baglike with either smooth walls or large, bellows-shaped respiratory units extending from the outer wall of the lung into a central air space. The bronchoalveolar lung of mammals is a branching “tree” of tubes leading to millions of tiny respiratory exchange units, termed alveoli. In humans there are ~25 branches and 300 million alveoli. This structure allows for the generation of an enormous respiratory surface area (up to 70 m² in adult humans) (Daniels & Orgeig, 2003, p151). But all lungs have one common characteristic lungs (Daniels & Orgeig, 2003, p151). They are internal, fluid-lined, gas-holding structures that inflate and deflate cyclically (Daniels & Orgeig, 2003, p151). As a result, all lungs face potential problems related to the surface tension of the fluid. Pulmonary surfactant is produced in the lung to decrease surface tension of this fluid. Pulmonary surfactant covers our alveoli and allows tidal breathing at normal airway pressures.

Lack of pulmonary surfactant (in pre-term children) or inactivation of surfactant leads to the progressive deterioration of lung function. In pre-term children this can lead to respiratory distress syndrome (RDS) and in adults to acute respiratory distress syndrome (ARDS). If one can reverse the surfactant deficiency one can expect also to improve lung function and ultimately this may reduce the mortality rates in ARDS patients. Therefore, it would be logical to supplement the ARDS lung with exogenous surfactant. In this manuscript we will discuss the use of surfactant therapy for RDS and ARDS.

THE ROLE OF SURFACTANT IN THE LUNG

Kurt von Neergaard was the first to suggest that surface tension plays a role in lung elasticity (1929). He showed, in 1929, that the pressure necessary to fill the lung with liquid was less than half the pressure needed to fill the lung with air. His explanation for this remarkable difference was based on the assumption that in each alveolus there must be a barrier between air and fluid, with a tendency to reduce the size of the alveolus according to the law of LaPlace (Fig. 1) (Von Neergaard, 1929). The law of LaPlace, \( P = \frac{2g}{r} \) (\( P \) = pressure in the bubble; \( g \) = surface tension; \( r \) = radius of the bubble), states that a reduction of the radius of a bubble needs an equal reduction in surface tension, to keep the bubble stable. When the lung was filled with fluid, the air-liquid interface was replaced by a liquid-to-liquid barrier, which thus eliminates the retractive forces which existed due to surface tension properties. A healthy lung (e.g. alveoli) does not collapse at the end of expiration, so there must be a stabilizing force that prevents alveolar collapse. The law of LaPlace shows that when the radius of the alveolus is decreased, the surface tension has to be decreased concomitantly; which can only be accomplished by a dynamic behavior of the surface tension lowering material.

Surfactant (surface active agent) in the human lung is a composition of phospholipids (85-90%), neutral lipids (4-7%) and at least four specific surfactant-proteins (6-8%) (SP-A, SP-B, SP-C and SP-D) (Possmayer et al., 1984). It is synthesized and secreted from the alveolar type II cells. Surfactant lies as a monolayer at the air liquid interface and reduces the surface tension in the lung. Due to this effect, breathing in physiological transpulmonary pressures is possible and the alveolar collapse is prevented (fig 2). Pulmonary surfactant has a dynamic surface tension allowing it to change the surface tension according to the size of the alveolus. Additionally, it is essential to maintain fluid balance in the lung. Specific surfactant proteins are essential for the functioning of the surfactant system. SP-A regulates the secretion and the uptake of the surfactant from the type II cells. SP-B and SP-C enable the adsorption of the phospholipids molecules into the monolayer rapidly. SP-A and SP-D play a role in the lung’s defense against infection (Haagsman et al., 2008).

PROPERTIES OF SURFACTANT

The normal physiological functions of the pulmonary surfactant system include:

- Mechanical stabilization of lung alveoli; during deflation of the lung a static high surface tension would tend to promote alveolar collapse. The dynamic surface tension behavior of surfactant prevents this.
- Transport of mucus and inhaled particles; besides its role in mechanical stabilization of the peripheral airways it acts as an antiglue factor, preventing the development of large adhesive forces between mucus and the bronchial wall (Lachmann, 1985).
- Protection against lung edema; another important function of surfactant is stabilization of the fluid balance in the lung, especially across the alveolar-capillary membrane.

In general, alveolar flooding will not occur when the surfactant system is properly functioning; however, when the surface tension rises above a critical level alveolar flooding will occur. Alveolar flooding will lead to influx of proteins into the alveolar space and, hence, further inactivation of surfactant (Lachmann et al., 1994; Seeger et al., 1985).

- Local defense against infection; it has been demonstrated that surfactant and in particular surfactant protein A (SP-A) and probably SP-D, enhances the antibacterial and antiviral defense of alveolar macrophages (van Iwaarden et al., 1990).

SURFACTANT THERAPY IN PRE-TERM INFANTS

In pre-term infants the immaturity of the lungs puts them at risk for respiratory distress syndrome (RDS). RDS is due to a deficiency and immaturity of alveolar surfactant along with structural immaturity of the lung and it is mainly, but not exclusively, confined to preterm babies. The incidence of RDS increases with decreasing gestation, with EuroNeoStat figures for 2006 showing an incidence of 91% at 23–25 weeks, 88% at 26–27 weeks, 74% at 28–29 weeks, and 52% at 30–31 weeks’ gestation (Sweet et al., 2010, p403). The lack
of a functional surfactant system makes these infants a logical recipient for exogenous surfactant therapy. Fujiiwa et al. in 1980 in the Lancet published the first case series on surfactant therapy in pre-term infants (1980). Exogenous surfactant dramatically improved resolution of chest x-ray findings and reduced ventilator settings in 10 preterm babies with severe RDS (Fujiwara et al., 1980). Since then surfactants, along with antenatal steroids and assisted ventilation, have dramatically improved neonatal outcomes.

Currently preterm births continue to increase in spite of major advances in perinatal care, especially in developed countries (Goldenberg & Rouse, 1998). In the USA, the preterm delivery rate is 12–13% and in Europe and other developed countries, reported rates are generally between 5 and 9% (Slattery & Morrison, 2002). Prematurity is now the number one cause of infant mortality accounting for 1 in 3 infant deaths in 2002 (Callaghan et al., 2006). Surfactant therapy has become the standard of care in preterm infants with and at risk for RDS and is associated with a decrease in pneumothorax, and neonatal and infant mortality. And current recommendation in the European consensus guidelines suggest giving surfactant as a prophylaxis (within 15 min of birth) to almost all babies of <26 weeks gestation (Sweet et al., 2010). Prophylaxis should also be given to all preterm babies with RDS who require intubation for stabilisation (Sweet et al., 2010).

**SURFACTANT THERAPY IN ADULTS**

Although the supportive therapy in intensive care units have greatly improved during the last decades, recent epidemiological studies have shown that Acute Lung Injury/Acute Respiratory Distress Syndrome (ALI/ARDS) still has a high mortality of 40-50% (Luhr et al., 1999; The ARDS network, 2000). This points to the necessity of new therapies directed to the cause of the pathology. Although a multitude of causes can lead to ALI/ARDS, the dysfunction of the endogenous surfactant system is a shared characteristic. These alterations of the surfactant system have been documented in several diseases and even prolonged mechanical ventilation induces these changes (Tsangaris et al., 2003). Therefore it has been suggested to use surfactant replacement therapy in patients with ARDS in order to overcome ongoing inactivation of endogenous surfactant by plasma proteins entering the alveolar spaces (Kesecioglu & Haitsma, 2006).

However there is a major difference in the lack of active surfactant between neonatal RDS and adult ALI/ARDS. First, in ARDS the surfactant deficiency is a complication rather than, as in neonatal RDS, a primary etiological factor. Analyses of lung surfactant recovered in bronchoalveolar lavage (BAL) from patients with ARDS demonstrate disturbances of the lung surfactant system. Gregory and co-workers demonstrated that several of these alterations already occur in patients at risk of developing ARDS, suggesting that these abnormalities of surfactant occur early in the disease process (1991).

Secondly, because of the presence of strong surfactant inhibitors in the alveoli, the dosage of exogenous surfactant needs to be increased, up to 800 mg/kg bodyweight whereas in neonatal RDS a dosage of 50 to 200 mg/kg bodyweight is normal. Our group has shown that approximately 1 mg of surfactant is needed to overcome the inhibitory effect of 1 mg plasma proteins (Lachmann et al., 1994). In ARDS there is an accumulation of proteins in the lungs over time, resulting again in the need for higher doses.

Finally, there is an economic reason, the amount of surfactant needed for an adult ARDS patient would be around 10 -20 g. At current prices the costs of one treatment would be US$ 30,000-50,000 per patient.

Evidently surfactant treatment for ARDS patients is more complicated than surfactant therapy in RDS patients. Despite these differences surfactant trials in both adults and children have been performed.

**PHASE III STUDIES**

Three phase III studies in adults and one study in pediatric patients with ARDS have been reported so far. Anzueto et al. (1996) used aerosolized surfactant in adults with sepsis induced ARDS. In a multicenter, double-blind, placebo controlled trial, they randomized the patients to receive either Exosurf (364 patients) or 0.45% saline (361 patients) up to 5 days. No improvement of oxygenation was observed with the instillation of exogenous surfactant. The mortality at 30 days of both groups was 40%. The investigators concluded that the continuous administration of aerosolized synthetic surfactant to patients with sepsis-induced ARDS had no beneficial effects.

Spragg et al. (2004) performed two independent multicenter, randomized, parallel-group, double-blind, controlled studies involving 448 patients with ARDS. They compared standard therapy alone with standard therapy plus up to four intratracheal doses of rSP-C based surfactant given within a period of 24 hours. Although there was a significant improvement of oxygenation in the first 24 h, no improvement of survival was observed due to exogenous surfactant instillation. The combined data showed 68% survival in the control group and 64% in the surfactant group. They concluded that routine use of surfactant in the treatment of patients with ARDS is not justified.

Kesecioglu et al. (2009) randomized 418 patients with ALI and ARDS in an international, multicenter, controlled, open, parallel-group study. Patients received usual care either with or without instillation of exogenous natural porcine surfactant HL 10 as large boluses (3 in total).

Mortality at 28-day in the usual care group was 24.5% compared with 28.8% in the surfactant group. The most common adverse events related to HL 10 administration were temporary hypoxemia defined as oxygen saturation less than 88% (51.9% in HL 10 group vs. 25.2% in usual care) and hypotension defined as mean arterial blood pressure less than 60 mm Hg (34.1% in HL 10 group vs. 17.1% in usual care). They concluded that instillation of a large bolus of exogenous natural porcine surfactant (HL 10) into patients with acute lung injury and ARDS does not improve outcome and showed a trend toward increased mortality and adverse effects.
Willson et al. (2005) in 2005 reported their multicenter, randomized, blinded phase III trial of calfactant (natural lung surfactant) compared with placebo in 153 infants, children, and adolescents with respiratory failure from ALI. Patients were treated with intratracheal instillation of 2 doses of 80 mL/m² calfactant or an equal volume of air placebo administered 12 hours apart. Mortality was significantly greater in the placebo group (27%) compared with the 19% in the calfactant group (27/75 vs. 15/77), although ventilator-free days were not different. More patients in the placebo group did not respond to conventional mechanical ventilation. Calfactant acutely improved oxygenation and significantly decreased mortality in infants, children, and adolescents with ALI.

Thus in adult phase III trials surfactant therapy has failed to demonstrate any beneficial effect on outcome either mortality or ventilator-free days. Only in a phase III trial in pediatric patients exogenous surfactant reduced mortality. So why are the results so different between adult and pediatric patients?

### NATURAL AND SYNTHETIC SURFACTANTS

There are major differences in exogenous surfactant used in many published studies. Several different surfactant compositions are used in the reported studies. Exogenous surfactant preparations can be classified in many ways depending how they are produced. A simpler classification would be natural surfactant (either bovine or porcine) or synthetic surfactant. Natural surfactants have the advantage of containing SP-B and SP-C which is assumed to be the determinant factor in the beneficial effects of exogenous surfactant (Gommers et al., 1998). On the other hand the synthetic surfactant is cheaper and can be produced in large quantities (considered ideal for the adult patients requiring large amounts). However, they either do not contain surfactant proteins at all or rSP-C only and no SP-B (Anzueto et al., 1996; Spragg et al., 2004). Recombinant (r)SP-C is an analogue of human SP-C with small changes in protein structure and it has been suggested that the ability to stabilize airways is higher in natural surfactants. Natural surfactants have been found to be more effective in increasing arterial oxygenation and alveolar stability and are less sensitive to inhibition by serum proteins and other inflammatory mediators (Gommers et al., 1998). In a study on premature neonates comparing a natural surfactant with a synthetic surfactant, a significant lower mortality was observed when treated with the natural surfactant (Ainsworth et al., 2000).

Animal-derived surfactants, as well as synthetic surfactants, have been extensively evaluated in the treatment of RDS in preterm infants. To date, animal-derived surfactants seem to be better than synthetic surfactants during the acute phase of RDS and in decreasing neonatal mortality (Ramanaathan, 2009). These results might be a possible explanation for the lack of surfactant effect on mortality in the previous studies performed where investigators used synthetic exogenous surfactant (Anzueto et al., 1996; Spragg et al., 2004).

### Table 1. Phase III study on surfactant replacement therapy in patients with ALI/ARDS.

<table>
<thead>
<tr>
<th>Author name [ref]</th>
<th>Surfactant name; type of surfactant</th>
<th>Instillation technique</th>
<th>Study details</th>
<th>Diagnosis, P/F</th>
<th>No. of pts</th>
<th>Main results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anzuetto (1996)</td>
<td>Exosurf; synthetic surfactant</td>
<td>Aero-solization</td>
<td>Phase III study: Prospective, multi-center, randomized placebo controlled trial</td>
<td>ARDS/ALI + Sepsis, P/F &lt; 250</td>
<td>725</td>
<td>No beneficial effects of surfactant administration</td>
</tr>
<tr>
<td>Spragg (2004)</td>
<td>Venticute; Synthetic surfactant + rSP-C</td>
<td>Intra-tracheal</td>
<td>Phase III study: Prospective, multi-center, randomized trial</td>
<td>ARDS, P/F &lt; 200</td>
<td>448</td>
<td>No beneficial effects of surfactant administration</td>
</tr>
<tr>
<td>Kesecioglu (2009)</td>
<td>HL-10; Natural surfactant (porcine)</td>
<td>Bolus</td>
<td>Phase III study: Prospective, multi-center, randomized trial</td>
<td>ARDS/ALI, P/F &lt; 300</td>
<td>428</td>
<td>No beneficial effects of surfactant administration, trend towards increased mortality with surfactant</td>
</tr>
<tr>
<td>Willson (2005)</td>
<td>Calfactant; natural surfactant (bovine)</td>
<td>Intra-tracheal</td>
<td>Phase III study; Prospective, multi-center, randomized trial</td>
<td>Infants, children and adolescents with ALI, P/F &lt; 300</td>
<td>153</td>
<td>Surfactant decreased mortality 19% vs. 27% and improved oxygenation</td>
</tr>
</tbody>
</table>

ARDS: Adult Respiratory Distress Syndrome; ALI: Acute Lung Injury; P/F: PaO₂/FiO₂ ratio
DETERMINANT FACTORS IN SURFACTANT THERAPY
From both animals and human studies several factors have been demonstrated to influence surfactant therapy efficacy.

Dose of surfactant
The dose of exogenous surfactant must be large enough to overcome all the inhibitors present in the ALI/ARDS lung. Furthermore, it may be necessary to install surfactant more than once. Gregory and colleagues (1997) have used four different doses of surfactant. They demonstrated that the maximum improvement in oxygenation, minimum ventilatory requirements, and lowest mortality rate were obtained by using four and eight doses of 100 mg/kg of a natural surfactant (total amount of 400-800 mg/kg).

Technique of instillation
Several techniques of instillation have been used so far in the above mentioned studies. These techniques include aerosolisation (Anzueto et al., 1996), bronchoscopic instillation (Gunther et al., 2002; Walmrath et al., 2002) or direct intratracheal instillation (Gregory et al., 1997; Spragg et al., 2003). By using aerosolisation, only 4.5% of the radio-labeled surfactant reached the lungs. This means that the aerosolisation system used in the study by Anzueto et al. (1996) allowed the investigators to install less than 5 mg/kg of the dose of 112 mg/kg per day.

Bronchoscopic instillation is used successfully by some investigators. The advantage of this technique is the possibility of cleansing the airways if necessary and instillation to each segment of the lung selectively, targeting the most affected parts of the lungs individually. However, bronchoscopic instillation is a long procedure lasting 45 min (Walmrath et al., 2002), which might be a potential disadvantage in instable hypoxemic patients.

Other studies reported bolus instillation, which is the standard to administer surfactant in neonates with RDS. In adult patients this has been performed either by a catheter inserted via the endotracheal tube and advanced above the carina (Gregory et al., 1997; Spragg et al., 2003) or a syringe attached to the endotracheal tube (Kesecioglu et al., 2009). Both techniques were shown to be safe, effective and less time consuming. Although it has been argued that this way of instillation may give a problem with respect to the volume that is instilled into the lungs, it has been demonstrated that the volume of fluid that has to be instilled is rapidly absorbed. However, in the trial by Kesecioglu et al. bolus administration did result in temporary hypoxemia in patients treated this way (2009).

PATIENT SELECTION CRITERIA
One of the main problems that have hampered critical care research is the lack of a clear disease population. ALI/ARDS is syndrome in which the definition does not consider ventilatory settings. Recent publications indicate the importance of these settings on the outcome of ALI/ARDS patients (Ferguson et al., 2004; Villar et al., 2007). Furthermore, the site of injury; direct lung injury (pneumonia, aspiration, near-drowning) or indirect lung injury (sepsis, pancreatitis) is thought to affect the efficacy of surfactant therapy (Taut et al., 2008). Subgroup analysis of trials with rSP-C surfactant in severe ARDS due to pneumonia or aspiration showed that surfactant treatment was associated with significant improved oxygenation and survival, while this effect was present in the extrapulmonary (indirect) lung injury group (Taut et al., 2008).

The problems with selection of the right study population have not only been observed in surfactant trials but several other trials in ARDS patients have not been able to show treatment differences including trials on prone positioning and mechanical ventilation strategies (Gattinoni et al., 2001; Haitsma & Pelosi, 2008; Meade et al., 2008; Mercat et al., 2008; Taccone et al., 2009).

FIGURE 1. According to the law LaPlace surface when the airway pressure is similar (pressure= P) in alveoli of different size (difference in radius= r), the surface tension (γ) has to change accordingly. In this graph the surface tension in alveolus A will be higher than the surface tension in B to maintain alveolar stability. Pulmonary surfactant is able to dynamically reduce the surface tension.

CONCLUSIONS
Compositional changes or decreased content of surfactant are shown in the lungs of patients developing or with ALI/ARDS. Therefore, instillation of exogenous surfactant may restore the normal composition of the surfactant system of the lung and restore its surface activity, which would result in improvement of lung compliance and gas exchange.

Natural surfactant is supposed to be more effective due to the availability of surfactant proteins in its composition. Confirming this, premature neonates show an improvement of survival when natural surfactant is used compared to the synthetic surfactant. No such data is available for the adults with ALI/ARDS. The amount of surfactant instilled should be large enough, and maybe even repeated doses should be given, to overcome the ongoing inactivation of surfactant. Furthermore, the instillation technique used should make optimal distribution of the surfactant in the lung possible.
either by bolus or bronchoscopic administration. Finally, inclusion criteria should be more stringent also incorporating ventilator guidelines and selective patient populations. Many case reports, uncontrolled studies and phase II studies have shown beneficial effects of surfactant on oxygenation and mortality of patients with ALI/ARDS. However, recent randomized, controlled trials could not demonstrate any improvement of survival in these patients treated with surfactant. Interestingly, exogenous surfactant instillation has improved survival in pediatric patients. This might be due to the lower incidence of multiple organ failure seen with these patients compared to adults, which contribute to the mortality as an extrapulmonary (indirect lung injury) component. It is too early to conclude that exogenous surfactant has no place in the treatment of ALI/ARDS, as other surfactant preparations may show different effects due to their different compositions. However, considering the present results, exogenous surfactant is not recommended for routine use in patients with ALI/ARDS.

REFERENCES

FIGURE 2. Surface tension plot showing the surface tension behavior of lung surfactant, serum, and water. Lung surfactant shows dynamic surface tension behaviour, with low surface tension for lower surface areas and higher surface tension for higher surface areas. In ARDS, the lung surfactant at the air-liquid interface is replaced with serum, which displays much higher surface tensions for each surface area when compared to lung surfactant. Water does not display dynamic surface tension behaviour but a constant surface tension for different surface areas.


BIOGRAPHY

Jack Haitsma received his MD, PhD at the Erasmus University Rotterdam, the Netherlands. He did his PhD in: “Ventilator-induced mediator release: role of PEEP and surfactant”, at the Department of Anesthesiology under the supervision of Prof. Dr. B. Lachmann. And was staff member at this department until 2005. In 2005 he moved to Toronto, ON, Canada, to work with Dr. Arthur Slutsky to further explore the interaction of mechanical ventilation, multi-organ failure and sepsis. He currently works with dr. Slutsky as a research associate at the interdepartmental division of critical medicine at the University of Toronto. He is an author of over 70 peer reviewed publications, and multitude of book chapters and reviews. He also serves as a reviewer for all major critical related journals and has given several lectures around the world.

He has international collaboration with Germany, Netherlands, Sweden, Spain, Italy Brazil and the USA.

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QUESTIONS

1. Surfactant preparations containing proteins are:
   a) By definition artificial preparations
   b) Able to withstand edema inactivation better than surfactant preparations not containing proteins
   c) Not used for premature babies suffering from RDS
   d) Inactive in vivo because of the inactivation of surfactant by proteins

2. Surfactant does not:
   a) Protect against lung edema
   b) Stabilise peripheral airways
   c) Play a role in local defence mechanisms
   d) Increase ‘shear’ forces in the lung

3. Exogenous surfactant therapy for ARDS is not yet a reality due to:
   a) The unavailability of sufficient amounts of surfactant
   b) The fact that surfactant has shown no therapeutic effect in ARDS patients
   c) The fact that the high dosage needed for ARDS lungs can not be instilled into the lung
   d) The fact that surfactant stimulates anti-body production in vivo

4. Surfactant can not be instilled by:
   a) Bolus
   b) Bronchoscopic application
   c) Aerosol
   d) Intravenous fluids

5. Surfactant therapy is approved for:
   a) Neonates only
   b) Pediatric patients only
   c) Adults only
   d) All of the above

6. The difference between surfactant therapy in adults and neonates is
   a) The cost of treating a patient
   b) The amount of surfactant needed to overcome the inhibitors present in the lung
   c) The etiology of the disease (lack of surfactant vs. inactivation of surfactant)
   d) All of the above
7. **Phase III trials in surfactant therapy in adults:**
   a) Have not taken place
   b) Showed dramatic improvement in patient outcome
   c) Did not show any beneficial affect
   d) Resulted in approval of surfactant therapy in patients with ALI/ARDS

8. **RDS outcome has improved because of**
   a) Antenatal steroids
   b) Surfactant therapy
   c) Assisted ventilation
   d) All of the above

9. **Bronchoscopic surfactant administration is**
   a) Standard therapy in neonates
   b) Time consuming
   c) Inactivating surfactant
   d) All of the above

10. **ARDS patients selection for a surfactant trial should**
    a) Enroll only septic patients
    b) Enroll only indirect lung injury patients
    c) Try to standardize ARDS by using ventilation to homogenize the disease severity
    d) All of the above

11. **Surfactant does not contain**
    a) Neutral lipids
    b) Surfactant proteins
    c) Neutral proteins
    d) Phospholipids

12. **Natural surfactants**
    a) Are made of corn
    b) Are made of pigs
    c) Are made of palm oil
    d) Are made of chickens

13. **Surfactant stands for**
    a) Sugar phosphorylated protein
    b) Surface active agent
    c) Surfing actor
    d) Sure facts and results

14. **RDS is**
    a) Increased with increasing gestation
    b) Is exclusively confined to pre-term babies
    c) Preventable by surfactant therapy
    d) Only dependent on the structural immaturity of the lung

**QUIZ ANSWERS ON PAGE 50**
Assessment of cardiac remodeling in asymptomatic mitral regurgitation for surgery timing: comparative study of echocardiography and magnetic resonance imaging

Oner Ozdogan, Alper Yuksel, Cemil Gurgun, Meral Kayikcioglu, Oguz Yavuzgil and Cahide S Cinar


ABSTRACT (PROVISIONAL)

BACKGROUND

Early surgery is recommended for asymptomatic severe mitral regurgitation (MR), because of increased postoperative left ventricular (LV) dysfunction in patients with late surgery. On the other hand, recent reports emphasized a “watchful waiting” process for the determination of the proper time of mitral valve surgery. In our study, we compared magnetic resonance imaging (MRI) and transthoracic echocardiography to evaluate the LV and left atrial (LA) remodeling; for better definitions of patients that may benefit from early valve surgery.

METHODS

Twenty-one patients with moderate to severe asymptomatic MR were evaluated by echocardiography and MRI. LA and LV ejection fractions (EFs) were calculated by echocardiography and MRI. Pulmonary veins (PVs) were measured from vein orifices in diastole and systole from the tangential of an imaginary circle that completed LA wall. Right upper PV indices were calculated with the formula; (Right upper PV diastolic diameter- Right upper PV systolic diameter)/ Right upper PV diastolic diameter.

RESULTS

In 9 patients there were mismatches between echocardiography and MRI measurements of LV EF. LV EFs were calculated [greater than or equal to] 60 % by echocardiography, meanwhile < 60% by MRI in these 9 patients. Severity of MR evaluated by effective regurgitant orifice area (EROA) didn’t differ with preserved and depressed EFs by MRI (p>0.05). However, both right upper PV indices (0.16+-/-0.06 vs. 0.24+-/-0.08, p: 0.024) and LA EFs (0.19+-/-0.09 vs. 0.33+-/-0.14, p: 0.025) were significantly decreased in patients with depressed EFs when compared to patients with normal EFs.

CONCLUSIONS

MRI might be preferred when small changes in functional parameters like LV EF, LA EF, and PV index are of clinical importance to disease management like asymptomatic MR patients that we follow up for appropriate surgery timing.

Effect of acute hypoxia on respiratory muscle fatigue in healthy humans

Samuel Verges, Damien Bachasson and Bernard Wuyam


ABSTRACT (PROVISIONAL)

BACKGROUND

Greater diaphragm fatigue has been reported after hypoxic versus normoxic exercise, but whether this is due to increased ventilation and therefore work of breathing or reduced blood oxygenation per se remains unclear. Hence, we assessed the effect of different blood oxygenation level on isolated hyperpnoea-induced inspiratory and expiratory muscle fatigue.

METHODS

Twelve healthy males performed three 15-min isocapnic hyperpnoea tests (85% of maximum voluntary ventilation with controlled breathing pattern) in normoxic, hypoxic (SpO₂ = 80%) and hyperoxic (FiO₂ = 0.60) conditions, in a random order. Before, immediately after and 30 min after hyperpnoea, transdiaphragmatic pressure (Pdi,tw) was measured during cervical magnetic stimulation to assess diaphragm contractility, and gastric pressure (Pga,tw) was measured during thoracic magnetic stimulation to assess abdominal muscle contractility. Two-way analysis of variance (time x condition) was used to compare hyperpnoea-induced respiratory muscle fatigue between conditions.

RESULTS

Hypoxia enhanced hyperpnoea-induced Pdi,tw and Pga, tw reductions both immediately after hyperpnoea (Pdi,tw: normoxia -22 +/- 7% vs hypoxia -34 +/- 8% vs hyperoxia -21 +/- 8%; Pga,tw: normoxia -17 +/- 7% vs hypoxia -26 +/- 10% vs hyperoxia -16 +/- 11%; all P < 0.05) and after 30 min of recovery (Pdi,tw: normoxia -10 +/- 7% vs hypoxia -16 +/- 8% vs hyperoxia -8 +/- 7%; Pga,tw: normoxia -13 +/- 6% vs hypoxia -21 +/- 9% vs hyperoxia -12 +/- 12%; all P < 0.05). No significant difference in Pdi,tw or Pga,tw reductions was observed between normoxic and hyperoxic conditions. Also, heart rate and blood lactate concentration during hyperpnoea were higher in hypoxia compared to normoxia and hyperoxia.

CONCLUSIONS

These results demonstrate that hypoxia exacerbates both diaphragm and abdominal muscle fatigability. These results emphasize the potential role of respiratory muscle fatigue in exercise performance limitation under conditions coupling increased work of breathing and reduced O₂ transport as during exercise in altitude or in hypoxic patients.
Inflammatory changes in the airways of mice caused by cigarette smoke exposure are only partially reversed after smoking cessation

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ABSTRACT
BACKGROUND
Tobacco smoking irritates and damages the respiratory tract and contributes to a higher risk of developing lung emphysema. At present, smoking cessation is the only effective treatment for reducing the progression of lung emphysema, however, there is hardly anything known about the effects of smoking cessation on cytokine and chemokine levels in the airways. To the best of our knowledge, this is the first reported in vivo study in which cytokine profiles were determined after cessation of cigarette smoke exposure.

METHODS
The severity of airway remodeling and inflammation was studied by analyzing alveolar enlargement, heart hypertrophy, inflammatory cells in the bronchoalveolar lavage fluid (BALF) and lung tissue and by determining the cytokine and chemokine profiles in the BALF of A/J mice exposed to cigarette smoke for 20 weeks and 8 weeks after smoking cessation.

RESULTS
The alveolar enlargement and right ventricle heart hypertrophy found in smoke-exposed mice remained unchanged after smoking cessation. Although the neutrophilic inflammation in the BALF of cigarette smoke-exposed animals was reduced after smoking cessation, a sustained inflammation in the lung tissue was observed. The elevated cytokine (IL-1β and TNF-α) and chemokine (CCL2 and CCL3) levels in the BALF of smoke-exposed mice returned to basal levels after smoking cessation, while the increased IL-12 levels did not return to its basal level. The cigarette smoke-enhanced VEGF levels did not significantly change after smoking cessation. Moreover, IL-10 levels were reduced in the BALF of smoke-exposed mice and these levels were still significantly decreased after smoking cessation compared to the control animals.

CONCLUSION
The inflammatory changes in the airways caused by cigarette smoke exposure were only partially reversed after smoking cessation. Although smoking cessation should be the first step in reducing the progression of lung emphysema, additional medication could be provided to tackle the sustained airway inflammation.

RÉSUMÉ (PROVISOIRE) CONTEXTUE
La chirurgie précoce est recommandée pour la régurgitation mitrale (RM) grave asymptomatique, afin de mieux définir les patients susceptibles de bénéficier d’une chirurgie valvulaire hâtive.

MÉTHODES
Vingt-et-un patients présentant une RM asymptomatique modérée à grave ont été évalués par échocardiographie et IRM. Les fractions d’éjection (FE) AG et VG ont été calculées par échocardiographie et IRM. Les veines pulmonaires (VP) ont été mesurées à partir de l’orifice veineux en diastole et systole à partir de la tangente d’un cercle imaginaire complétant la paroi AG. Les indices de la veine pulmonaire droite supérieure ont été calculés en utilisant la formule (diamètre systolique de la VP sup. droite – diamètre systolique de la VP sup. droite/diamètre diastolique de la VP sup. droite).

RÉSULTATS
On a constaté chez neuf patients des écarts entre les mesures de FE VG par échocardiographie et IRM. Les FE VG ont été calculées ≥ 60 % par échocardiographie, et à < 60 % par IRM chez ces neuf patients. La gravité de la RM évaluée selon l’aire de l’orifice effectif de régurgitation (EROA) ne différait pas pour les FE préservées et abaissées par IRM (p>0,05). Cependant, tant les indices de veine pulmonaire supérieure droite (0,16+/−0,06 c. 0,24+/−0,08, p: 0,024) que les FE AG
(0,195±0,09 c. 0,33±0,14, p: 0,025) présentaient une diminution marquée chez les patients avec une FE abaissée comparativement aux patients présentant une FE normale.

CONCLUSIONS
L’IRM pourrait être préférable lorsque de faibles changements dans les paramètres fonctionnels comme FE VG, FE AG et l’indice VP jouent un rôle clinique important dans la gestion de maladies, comme c’est le cas pour les patients de RM asymptomatique que nous suivons pour établir le moment approprié de la chirurgie.

Effect of acute hypoxia on respiratory muscle fatigue in healthy humans
(État de l’hypoxie aiguë sur la fatigue du muscle respiratoire chez les êtres humains en santé)
Samuel Verges, Damien Bachasson et Bernard Wuyam

RÉSUMÉ (PROVISOIRE)
CONTEXTE
Un degré de fatigue plus élevé du diaphragme a été signalé après des périodes d’exercice hypoxique comparativement à l’exercice normoxique, mais que cela soit dû à une augmentation de la ventilation et donc du travail de respiration ou à la diminution de l’oxygénation du sang comme tel reste incertain. Nous avons donc mesuré les effets de différents niveaux d’oxygénation sur la fatigue du muscle respiratoire résultant de l’hyperpnée à l’inspiration et à l’expiration.

MÉTHODES
Vingt sujets mâles en santé se sont livrés à un test d’hyperpnée à l’air sec (85 % de la ventilation volontaire maximum avec des rythmes respiratoires contrôlés), dans des conditions normoxiques, hypoxiques (SpO₂ = 80 %) et hyperoxique (FiO₂ = 0,60), en ordre aléatoire. Avant, immédiatement après, et 30 minutes après l’hyperpnée, la pression transdiaphragmatique (Pdi,tw) a été mesurée durant la stimulation thoracique magnétique afin d’évaluer la contractilité du diaphragme, tandis que la pression gastrique (Pga,tw) a été mesurée durant la stimulation magnétique thoracique afin d’évaluer la contractilité du muscle abdominal. Vingt-deux analyses de variance (temps x conditions) ont été utilisées pour comparer la fatigue du muscle respiratoire induite par l’hyperpnée entre les conditions.

RÉSULTATS
L’hypoxie a augmenté les réductions de Pdi,tw et Pga, induites par l’hyperpnée tant immédiatement après l’hyperpnée (Pdi,tw: normoxie -22 +/- 7% c. hypoxie -34 +/- 8% c. hyperoxie -21 +/- 8%; Pga,tw: normoxie -17 +/- 7% c. hypoxie -26 +/- 10% c. hyperoxie -16 +/- 11%; tous les P < 0,05) et après 30 minutes de récupération (Pdi,tw: normoxie -10 +/- 7% c. hypoxie -16 +/- 8% vs hyperoxie -8 +/- 7%; Pga,tw: normoxie -13 +/- 6% c. hypoxie -21 +/- 9% c. hyperoxie -12 +/- 12%; tous les P < 0,05). Aucune différence notable n’a été observée dans la réduction des Pdi,tw ou Pga,tw entre les conditions normoxiques et hyperoxiques. De même, la fréquence cardiaque et la concentration de lactate dans le sang durant l’hyperpnée ont été plus élevées en hypoxie comparativement à la normoxie et à l’hyperoxie.

CONCLUSIONS
Ces résultats démontrent que l’hypoxie augmente la fatigue du diaphragme et du muscle abdominal. Ils soulignent le rôle potentiel de la fatigue du muscle respiratoire pour limiter le rendement de l’exercice dans des conditions réunissant un travail respiratoire accru et un transport d’oxygène réduit, comme dans le cas de l’exercice en altitude ou chez les patients hypoxémiques.

Inflammatory changes in the airways of mice caused by cigarette smoke exposure are only partially reversed after smoking cessation
(Les changements inflammatoires dans les voies respiratoires de souris causés par l’exposition à la fumée de cigarette ne sont que partiellement renversés après l’arrêt de l’usage du tabac)
Saskia Braber, Paul AJ Henricks, Frans P Nijkamp, Aletta D Kraneveld et Gert Folkerts
Division de pharmacologie, Utrecht Institute for Pharmaceutical Sciences, Faculté des sciences, Université d’Utrecht, Utrecht, Pays-Bas

RÉSUMÉ
CONTEXTE
La fumée de cigarette irrite et endommage les voies respiratoires et contribue à augmenter le risque de développer l’emphysème pulmonaire. À l’heure actuelle, cesser de fumer est le seul traitement efficace pour réduire la progression de l’emphysème pulmonaire, mais on connaît très peu de choses sur les effets de l’interruption de l’usage du tabac sur les niveaux de cytokine et de chimiokine dans les voies respiratoires. Selon nos recherches, cette étude est la première étude in vivo dans laquelle les profils de cytokine ont été déterminés après l’arrêt de l’exposition à la fumée de cigarette.

MÉTHODES
La gravité du remodelage et de l’inflammation des voies respiratoires a été étudiée en analysant l’agrandissement alvéolaire, l’hypertrophie cardiaque, les cellules inflammatoires dans le liquide de lavage broncho-alvéolaire et dans les tissus pulmonaires et en déterminant les profils de cytokine et de chimiokine dans le liquide de lavage broncho-alvéolaire de souris A/J exposées à la fumée de cigarette pendant 20 semaines et huit semaines après la fin de l’exposition.

RÉSULTATS
L’agrandissement alvéolaire et l’hypertrophie du ventricule droit chez les souris exposées à la fumée de cigarette persistent après l’arrêt de l’exposition. Bien que l’inflammation
neutrophile dans le fluide de lavage broncho-alvéolaire des animaux exposés à la fumée de cigarette ait diminué après le retrait de l’irritant, une inflammation pulmonaire soutenue a été observée. Le niveau élevé de cytokine (IL-1 et TNF-) et de chimiokine (CCL2 et CCL3) dans le fluide de lavage broncho-alvéolaire des souris exposées à la fumée est revenu au niveau de base après l’arrêt de l’exposition, tandis que le niveau IL-12 n’est pas revenu à son niveau de base. Le niveau VEGF augmenté par la fumée de cigarette n’a pas changé de manière significative après l’arrêt de l’exposition. De plus, les niveaux IL-10 qui avaient diminué dans le fluide de lavage broncho-alvéolaire des souris exposées à la fumée restaient notablement diminués après l’interruption de l’exposition, comparativement aux animaux du groupe de contrôle.

CONCLUSION
Les changements inflammatoires dans les voies respiratoires causés par l’exposition à la fumée de cigarette n’ont été que partiellement inversés après l’interruption de l’exposition. Bien que cesser de fumer soit la première étape à suivre pour réduire la progression de l’emphysème pulmonaire, une médication additionnelle pourrait être utilisée pour corriger l’inflammation soutenue des voies respiratoires.

DIRECTED READING ARTICLE ANSWERS

1. B
2. D
3. A
4. D
5. A
6. D
7. C
8. D
9. B
10. C
11. C
12. B
13. B
14. C
Promoting Our Profession Begins as Students

Krystle Hong, BSc.
Director of Student Relations, CSRT Board of Directors

As I begin the first couple months of the second year of my RT program, I am able to reflect on all I have learned in my first year and all I will be building on in the semesters to come. I recall applying for acceptance into the Respiratory Therapy Program at NAIT (Edmonton, AB). I had researched the roles and responsibilities of a RT, but I was not prepared or fully aware of the full potential of this career.

Since finishing my first year, I have discovered that RTs have numerous responsibilities that do not only include operating ventilators. If you wish to learn and grow in a high-risk, fast-paced health care environment, this profession is for you. If you wish to thrive in patient-focused care, this profession is also for you. The areas of employment are versatile and endless. The CSRT is your source of information to aid in the steps to becoming a respiratory therapist. To find out more about the profession and to promote for and advocate for the profession, the CSRT is there.

Beginning the education portion of my career, I was not even aware of the existence of the CSRT let alone what the role of the CSRT was. Once learning of my appointment as the Director of Student Relations, I quickly learned the differences between a professional association versus a regulatory board. The CSRT is the only national professional association in Canada that represents respiratory therapist and RT students. The association promotes the profession and supports and advocates for its members. It provides opportunities for professional development and creates a platform for information dissemination. The CSRT is responsible to its members, while a regulatory board is responsible to the public and the government. The roles of a regulatory body are to ensure profession competence to ensure public safety and to uphold a standard of practice. Even as students preparing to enter the profession, we should participate in and be aware of the mission and the vision of the CSRT.

To make it affordable and effortless, the CSRT has a membership category for students. Membership to students is available from the first day of classes to one year after you graduate for a one-time fee of $100.00. This means that you could receive membership for up to four years. Membership to the CSRT includes discounted rates to the Annual Education and Conference and Trade Show, a nationally and internationally recognized designation, a subscription to the Canadian Journal of Respiratory Therapy (CJRT), and access to a network of other RT students through the CSRT LISTSERVS. The CSRT awards the CSRT Student Achievement Award, for which you have to be a CSRT member to be eligible. Additionally, my participation on the board of directors was established to liaise with students. This avenue for communication will allow the board to understand students’ views and concerns, especially towards the future of the profession. Most importantly, your membership into the CSRT provides you with free professional liability insurance during clinical practice, as long as you practice under a RRT who is a member of the CSRT with professional liability insurance. Check for details under Membership on the CSRT website.

By promoting our profession as students, we are able to ensure the sustainable continuation of respiratory therapist. The last week of October is RT week (October 24-30, 2010). It provides an opportunity to showcase our roles and responsibilities in the health care sector. Much of the public and even some health care providers are not sure of RT roles. Increasing awareness of our profession will assure that presence in health care will be recognized. To help promote our profession, at any time of the year, the CSRT has created a “how-to” guide. In addition to this article on the website (www.csrt.com), the CSRT has numerous resources, including a job bank, more information about the RT profession, position statements on issues that concern the public, and standards of practice information. As students, we need to recognize that this resource is available not only for studying purposes, but to utilize while in the workforce also.

I invite you and your classmates to celebrate RT Week with pride and professionalism. We would love to hear about how you participated! If you have more ideas on how to advocate for and promote the profession, please send me an email through the CSRT website. Consider posting your RT Week photos on our Facebook page.

The CSRT is responsible to its members and as such, we require student input to be able to succeed in our goal of providing national leadership through advocacy, service, and unity. If you have questions, concerns, ideas, or just want to let me know about your Respiratory Therapy class, please send me an email.

I look forward to hearing about your RT week celebrations and more.
La promotion de notre profession commence dès le début des études

Krystle Hong, BSc.
Administratrice – Relations avec les étudiants – CA de la SCTR

Au moment d’entreprendre la deuxième année du programme de TR, je suis en mesure de me pencher sur tout ce que j’ai appris au cours de ma première année et sur ce que je franchirai dans les semestres qui viennent. En passant en revue les étapes de mon inscription au programme de thérapie respiratoire du NAIT (Edmonton, Alb.), je connaissais les rôles et les responsabilités d’un TR mais je n’étais pas pleinement consciente de tout le potentiel de cette carrière.

Depuis la fin de ma première année, j’ai constaté que les TR asserment de nombreuses responsabilités qui ne se limitent pas au fonctionnement des ventilateurs. Si vous souhaitez travailler et apprendre dans un milieu de soins de santé à haut risque et en rapide évolution, la profession vous conviendra. Si vous vous intéressez aux soins des patients, la profession vous conviendra également. Les secteurs d’emploi sont polyvalents et illimités. La SCTR est une excellente source de renseignements pour vous aider à franchir les étapes menant à l’exercice de la thérapie respiratoire. De plus, elle assure la promotion de la profession et la défense des intérêts des TR.

Au moment d’entreprendre mes études, je n’étais pas au courant de l’existence de la SCTR et encore moins du rôle qu’elle joue. Lorsque j’ai été nommée au poste d’administratrice des relations avec les étudiants, j’ai rapidement appris la différence entre une association professionnelle et un organisme de réglementation. La SCTR n’est pas seulement l’association nationale canadienne qui représente les thérapeutes respiratoires et les étudiants en TR. Elle assure la promotion de la profession et elle appuie et défend ses membres. Elle offre des occasions de perfectionnement professionnel et constitue une tribune de diffusion de l’information.

La SCTR rend compte à ses membres tandis qu’un organisme de réglementation rend compte au public et au gouvernement. Le rôle d’un organisme de réglementation consiste à confirmer la compétence des membres d’une profession de sorte que la sécurité du public soit assurée et que les normes d’exercice soient respectées. Même à titre d’étudiants se préparant à l’exercice de la TR, nous devons prendre part aux activités de la SCTR et connaître sa mission et sa vision.

La SCTR facilite l’adhésion des étudiants en prévoyant une catégorie abordable à leur intention. Les étudiants peuvent s’inscrire à l’association dès le premier jour de leurs études jusqu’à une année après l’obtention du diplôme au coût de 100 $, soit une adhésion pouvant s’étendre sur quatre ans. L’adhésion à la SCTR comprend une réduction des frais d’inscription au congrès annuel, une désignation reconnue nationalement et internationalement, l’abonnement au Journal canadien de thérapie respiratoire (JCTR) et l’accès à un réseau d’étudiants en TR par le biais de groupes de discussion. La SCTR remet le prix de réalisation étudiante auquel sont admissibles les étudiants membres de l’association. De plus, mon poste au conseil d’administration sert de lien avec les étudiants, ce qui permet au conseil de comprendre les points de vue et les préoccupations des étudiants, plus particulièrement en ce qui concerne l’avenir de la profession. Il faut mentionner aussi que l’adhésion à la SCTR vous donne droit à une assurance de responsabilité professionnelle gratuite durant les heures d’exercice clinique, tant et aussi longtemps que vous exercez sous la supervision d’un TRA membre de la SCTR et dont l’assurance de responsabilité professionnelle est en règle. Pour de plus amples renseignements à ce sujet, voir la section de l’adhésion du site Web de la SCTR.

En assurant la promotion de notre profession en tant qu’étudiants, nous assurons la durabilité du métier de TR. Du 24 au 30 octobre 2010 se tiendra la semaine des TR. Elle offre l’occasion de faire connaître nos rôles et nos responsabilités au sein du secteur des soins de santé. Une grande partie du public et même certains soignants ne comprennent pas bien le rôle de TR. Faire connaître notre profession nous permet d’être reconnus. À cet effet, la SCTR a conçu document de lignes directrices. En plus de cet article sur le site Web (www.csrt.com), la SCTR compte de nombreuses ressources, dont une banque d’emplois, des renseignements sur la profession de TR, des déclarations sur des enjeux qui concernent le public et des normes sur l’exercice de la profession. À titre d’étudiants, nous devons connaître l’existence de ces sources de renseignements qui nous serviront plus tard lorsque nous adhérerons au marché du travail.

Je vous invite tous à célébrer la semaine des TR avec fierté et professionnalisme. Nous aimerions recevoir des comptes rendus sur votre participation! Pour nous faire part de vos idées de promotion et de défense de la profession, veuillez communiquer avec moi par courriel par le biais du site Web de la SCTR. Vous pourriez aussi afficher vos photos de la semaine sur notre page Facebook.

La SCTR rend compte à ses membres et c’est pourquoi, nous avons besoin de l’opinion des étudiants pour atteindre notre but d’exercer un leadership national par la défense des intérêts, le service et l’unité. Pour de plus amples renseignements, pour exprimer vos préoccupations, pour formuler des suggestions, ou encore pour simplement me parler de vos cours, vous pouvez me faire parvenir un courriel.

Je recevrai avec plaisir vos comptes rendus sur la célébration de la semaine des TR dans votre milieu, et plus encore.
Canadian Team Provides Respiratory Training in China

Michael Lemphers, RRT, MA, President, Canadian Society of Respiratory Therapists

Promotion of respiratory therapy at local, provincial, national and international levels is vital for the growth of our profession. Effective respiratory care practice is essential for optimal health care. Canadian respiratory therapists from Thompson Rivers University (TRU) in Kamloops, British Columbia are promoting and improving respiratory therapy practice in China. This past July marked the fourth respiratory therapy training class delivered by TRU and Hunan Provincial People’s Hospital (HPPH) in Changsha, China. Changsha is the capital city of the Hunan province; it has a population of six million people.

As respiratory therapy is not yet an established health profession in China, there are only a few internationally-trained respiratory therapists in the entire country. Prior to the implementation of this program in 2007, there were no respiratory therapists in Changsha. Having recognized the need to improve their ability to provide critical respiratory care, representatives from HPPH approached TRU in 2006 to deliver training for physicians and nurses. Through the past four years, physicians and nurses have traveled from many different provinces in China to attend the training program. This year, instructors from TRU provided four weeks of class and laboratory instruction to over 60 students. Topics included core adult and neonatal critical care subjects such as ventilator management and discontinuation, waveform interpretation and analysis, protective lung strategies, noninvasive ventilation and more.

Obviously, four weeks is a limited time in which to provide comprehensive respiratory therapy training. The key was to create a clinically applicable critical care program that was financially viable for HPPH. Feedback from previous programs has been very positive. One physician wrote in an email that he felt much better prepared to ventilate H1N1 cases as a result of having completed the training program last summer.

Many students have limited English language skills. Therefore, skillful interpreters are essential to the success of the program. Interpreters translated classroom lectures sentence by sentence. As the lectures progressed, so did the complexity of the medical language. The students required a foundational understanding of the material before subsequent lectures built upon this knowledge. Though students were initially reluctant to ask questions, they quickly opened up once we established a relationship with them. Lab sessions were a flurry of activity as students worked their way through different cases. Interpreters definitely helped in this setting, though I tried to answer as many questions as possible by myself through demonstration and drawing pictures. The only occasional drawback was when someone removed one of the lab ventilators to ventilate a critical patient in the emergency room (ER) or intensive care unit (ICU). The keys to success in this program are to be flexible and willing to adapt to different situations.

My colleague and I didn’t spend all of our time in the classroom and lab. Sometimes we would assess ventilated patients in ICU, ICN or ER in order to optimize respiratory care. Hospital physicians and nurses were always eager to work together with us to manage difficult ventilation cases. Sometimes we would use ventilators neither of us had ever seen before and displayed only Chinese text; we would need to ask interpreters to identify the controls before we began. We didn’t want to be changing rise time when we intended to change oxygen percentage!

During the many months that I have spent in Changsha over the past four years, I have realized that the people of Changsha are gracious, friendly, strong and proud. They work hard to do the best they can with the equipment they have. They also have a strong desire to be the best in whatever they do.

Western culture has definitely entered into mainland China. You can see it in the fashion, food and music. Many Chinese embrace this new culture alongside established traditional culture. This creates some important questions. How far will this transcend into medical culture? Will this lead to widespread acceptance of respiratory therapists in China? Will China eventually have accredited respiratory therapy programs? I am hopeful, though this may take several years, even decades.

One example of change relates to an incident I observed three years ago. In 2007, I observed a family visiting a patient in the ICU. The father was smoking beside the patient who was receiving supplemental oxygen. I told everyone about the fire hazard, but no one seemed too worried. Now there are “No Smoking” signs up everywhere at the hospital. I can even use the elevator without having to inhale cigarette smoke!

HPPH has changed over the past four years. The hospital has created a new respiratory therapy department staffed with nurses and doctors who have graduated from the TRU-HPPH training program. They provide a 24-hour service concentrating on the management of ventilated patients. Physicians in other areas of the hospital appreciate how these individuals can improve health care for their patients.

The future is improving for respiratory care in China. Already physicians and nurses from around China have participated in this training program as news of its success filter through the country. I have been asked by the president of the Taiwan Respiratory Care Society to speak at an international respiratory conference next year in China. Hopefully, this will lead to more respiratory therapists and training programs in China and around the world. As we share our knowledge and ideas, we all benefit.
Une équipe canadienne offre une formation en santé respiratoire en Chine

Michael Lemphers, TRA, MA, président de la Société canadienne des thérapeutes respiratoires

La promotion de la thérapie respiratoire aux échelons local, provincial, national et international est essentielle à la croissance de notre profession. La pratique efficace des soins respiratoires contribue à des soins de santé optimaux. Des thérapeutes respiratoires de l’Université Thompson Rivers (TRU) de Kamloops en Colombie-Britannique, mettent en valeur et améliorent la pratique de la thérapie respiratoire en Chine. En juillet dernier, le quatrième cours de formation en thérapie respiratoire a été donné par la TRU et le Hunan Provincial People’s Hospital (HPPH) à Changsha en Chine. Changsha est la capitale de la province du Hunan, avec une population de six millions d’habitants.

Étant donné que la thérapie respiratoire n’est pas encore une profession de santé établie en Chine, on n’y trouve que quelques thérapeutes respiratoires formés à l’étranger pour tout le pays. Avant la mise en œuvre de ce programme en 2007, il n’y avait aucun thérapeute respiratoire à Changsha. Ayant reconnu la nécessité d’améliorer leur capacité d’offrir des soins respiratoires essentiels, des représentants du HPPH ont communiqué avec la TRU en 2006 afin de solliciter une formation pour les médecins et les infirmières. Au cours des quatre dernières années, des médecins et des infirmières de différentes provinces de Chine ont assisté au programme de formation. Cette année, des formateurs de la TRU ont donné des cours en classe et en laboratoire pendant quatre semaines à plus de 60 étudiants. Parmi les thèmes abordés, signalons des sujets tels que les principaux soins intensifs pour adultes et nouveaux-nés, tels que la gestion et l’interruption des ventilateurs, l’interprétation et l’analyse des formes d’ondes, les stratégies de protection pulmonaire, la ventilation non invasive, etc.

Évidemment, une période de quatre semaines est limitée pour donner une formation complète en thérapie respiratoire. Il fallait créer un programme de soins intensifs applicable sur le plan clinique et viable financièrement pour le HPPH. Les commentaires sur les programmes précédents ont été très positifs. Un médecin a écrit dans un courriel qu’il se sentait beaucoup mieux préparé à ventiler les cas de H1N1 après avoir suivi le programme de formation l’été dernier.

De nombreux étudiants ont une connaissance limitée de anglais. Par conséquent, des interprètes qualifiés sont essentiels à la réussite du programme. Ces interprètes ont traduit les exposés en classe phrase par phrase. À mesure que ces exposés progressaient, il en était de même de la complexité des termes médicaux. Les étudiants devaient avoir une compréhension générale de la matière avant d’assister à d’autres exposés fondés sur ces connaissances. Même si les étudiants étaient d’abord hésitants à poser des questions, ils se sont ouverts rapidement, une fois la relation établie. Les séances en laboratoire fisaient d’activités pendant que les étudiants abordaient différents cas. Les interprètes ont nettement aidé à ce chapitre, bien que j’aie essayé de répondre au plus grand nombre de questions possible à l’aide de démonstrations et de dessins. La seule erreur occasionnelle fut lorsque quelqu’un a enlevé un des ventilateurs du laboratoire pour ventiler un patient dans la salle d’urgence ou dans l’unité des soins intensifs. Les clés de la réussite de ce programme consistent à être souple et disposé à s’adapter à différentes situations.

Mon collègue et moi-même n’avons pas passé tout notre temps dans la classe et le laboratoire. Il nous est arrivé d’évaluer des patients ventilés dans l’unité des soins intensifs ou la salle d’urgence afin d’optimiser les soins respiratoires. Les médecins et les infirmières de l’hôpital étaient toujours empressés de travailler avec nous afin de gérer des cas de ventilation difficiles. Parfois, nous avons utilisé des ventilateurs qu’aucun de nous n’avait vus auparavant et qui affichaient uniquement un texte en chinois. Nous devions demander aux interprètes de déterminer les contrôles avant de commencer. Nous ne voulions pas changer le temps de montée alors que nous voulions changer le pourcentage d’oxygène!

Pendant tous les mois que j’ai passés à Changsha au cours des quatre dernières années, je me suis rendu compte que les habitants de cette ville sont bienveillants, amicaux, forts et fiers. Ils s’efforcent de faire de leur mieux avec l’équipement dont ils disposent. Ils ont également un grand désir d’être les meilleurs dans tout ce qu’ils font.

La culture occidentale s’est manifestement introduite en Chine continentale. On peut le constater dans la mode, l’alimentation et la musique. De nombreux Chinois adoptent cette nouvelle culture auprès de la culture traditionnelle établie, ce qui donne lieu à des questions importantes. À quel point cela transcendera-t-il la culture médicale? Cela entraînera-t-il une acceptation générale des thérapeutes respiratoires en Chine? La Chine offrira-t-elle un jour des programmes de thérapie respiratoire? Je l’espère, bien que cela puisse exiger plusieurs années, voire des décennies.


Le HPPH a changé au cours des quatre dernières années. L’hôpital a créé un nouveau service de thérapie respiratoire dont le personnel se compose d’infirmières et de médecins diplômés du programme de formation TRU-HPPH. Ils offrent un service de 24 heures sur 24 concentré sur la gestion des patients ventilés. Les médecins d’autres secteurs de l’hôpital apprécient la façon dont ces personnes peuvent améliorer les soins de santé de leurs patients.

L‘avenir des soins respiratoires s’améliore en Chine. Déjà, des médecins et des infirmières de toute la Chine ont participé à ce programme de formation depuis que les nouvelles de sa réussite se sont répandues dans le pays. Le président de la Taiwan Respiratory Care Society m’a demandé de prendre la parole lors d’un congrès international sur la santé respiratoire à l’an prochain, en Chine. J’espère que cela mènera à un plus grand nombre de thérapeutes respiratoires et de programmes de formation en Chine et dans le monde entier. En propagant nos connaissances et nos idées, nous sommes tous gagnants.
The Respiratory Therapy Program team at College of the North Atlantic Qatar (CNAQ) is very proud to have received accreditation from CoARTE in August 2010. A self study was submitted to CoARTE in September 2009 to begin the process with a site visit from the accreditation team in March 2010. The Respiratory Therapy Program at CNAQ is the first program to attain international accreditation by CoARTE; a milestone that we are proud of. The feedback from the accreditation team was tremendously encouraging with a focus on the student's positive outlook on the program, the quality of the instructional resources and student experiences at our partner hospital Hamad Medical Corporation. The accreditation team commended the respiratory therapy team and CNAQ on its innovative practices and encouraged us to share them.

CNAQ is doing brilliant work to support growth and development of students who attend one of its many programs. The School of Health Science has a dynamic team who constantly work to employ strategies to facilitate student success. Interdisciplinary team case competitions, student of the month, and student exchanges between Canada and Qatar are a few initiatives that have been successfully implemented within the School of Health Sciences to encourage student success. The Respiratory Therapy Program has a strong team that work together to deliver a program that meets the Canadian accreditation standards and produces graduates that will be leaders in their community.

Individualized student profiles is one of the many strategies implemented at CNAQ that aim to provide a learner centred approach. Students who apply to CNAQ come to the program with unique abilities and backgrounds. Students may require preparation courses for math, sciences and English depending on high school grades and CNAQ admissions testing. A student profile is an individualized blueprint of courses organized by a student's academic need that will optimize time to graduation while balancing a workload that is right for each student. It is a fluid plan that also encourages student involvement in course selection required to meet the needs for graduation.

Student profiles organize courses by level, pre-requisites and co-requisites. Other considerations are taken into account when assigning a personalized student profile of courses. A student may take any combination math, science and English to prepare them for studies within the Respiratory Therapy Program. A student requiring English as a Foreign Language (EFL) and preparation math or sciences will take a full-time course workload which may include respiratory program courses. Students must have English preparation courses complete before taking courses that have an intensive language requirement such as biology, psychology, and communications. Student profiles are generally organized with math and EFL courses offered together as math tends to use language that generally requires less English proficiency. These CNAQ campus adjustments aim to meet the individualized needs of the student. Many students have the requirements to enter directly into the Respiratory Therapy Program courses and can graduate in 3 years.

A student profile is assessed on an ongoing basis throughout each semester to project course offerings for future semesters. The lead instructor will discuss the student profile with each student and make a plan for upcoming semester course workload. Courses may be taken earlier or postponed to another semester to fit the need of each student as long as the pre-requisites and co-requisites are maintained and the program is no lengthened. This allows the students the opportunity to participate in choosing courses and enables them to complete courses at a pace that is appropriate for them.

The student mentoring initiative ensures that an instructor is assigned to each student early in the student’s life at CNAQ so that they have someone to talk to about the student profile and anything that may be affecting their studies. The mentor initiates an introductory meeting to review the student profile that was created based on high school grades and admissions testing. Students are invited for a midterm follow up and have an open invitation to drop by at anytime to discuss student workload, course content, atten-
dance or personal matters. Mentors may refer students to the counsellor, the Advanced Writing Center, math or language help centers, school nurse, Dean or a suitable resource.

CNAQ offers multiple student admission points to provide opportunities for students to begin their studies in fall, winter or spring semesters. Semesters are generally 15 weeks long with the intersession semester being 8 weeks. Coupled with the flexibility provided by individualized student profiles, many of the respiratory therapy courses are offered in the fall and winter semester because of the 3 admission points. This allows students to drop and later pick up a course in an upcoming semester minimizing the effect on expected graduation date. A student is encouraged to discuss problems with the mentor, counsellor, respiratory therapy lead instructor, Dean or Chair of the School of Health Sciences if dropping a course will delay graduation. When a student feels that they need to drop a course, they have several avenues to explore. The School of Health Sciences has a dedicated guidance counsellor that will work with students to discuss the practicality of continuing with current workload while offering help on study skills, advice on getting organized or counselling in personal matters.

This unique way of scheduling courses for students requires dedicated preparation and planning. The lead instructor for the Respiratory Therapy Program along with the instructional coordinator for the School of Health Sciences work together to ensure that students have the best combination of courses to meet requirements as a full-time or part-time student. They ensure that students are grouped into cohorts to optimize class sizes and ensure that no student ends up in a course alone. It has been a colossal task to organize course offerings in this way with individualized schedules created manually. In March 2008 CNAQ implemented software to organize student profiles and to create schedules for over 2000 students each semester, all who generally have customized student profiles.

The Respiratory Therapy Program provides student centred education with a focus on providing a Canadian standard of education to its students. A high standard of English along with the Canadian curriculum ensures that graduates from the program at CNAQ will have the skills needed to work in the every changing world of respiratory therapy. CNAQ provides a dynamic environment with many student centered initiatives. Individualized student profiles have given students the flexibility be part of organizing their courses and optimizing the time that they spend in college.

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**CHRONIQUE DES ENSEIGNANTS**

**Profs étudiants – Un horaire axé sur l’étudiant**

Mary Parrott, TRA

Formation en thérapie respiratoire – Collège de l’Atlantique Nord - Qatar


Le CNAQ accomplit un travail superbe pour favoriser la croissance et le perfectionnement des étudiants inscrits à ses nombreux programmes. L’école des sciences de la santé se compose d’une équipe dynamique qui s’efforce continuellement d’adopter des stratégies qui favorisent la réussite des étudiants. Les concours de dossiers d’équipes interdisciplinaires,
l’étudiant du mois et les échanges d’étudiants entre le Canada et le Qatar ne sont que quelques-unes des initiatives qui ont été mises en place avec succès pour favoriser la réussite des élèves. Les membres de l’équipe du programme de thérapie respiratoire collaborent étroitement pour offrir un programme qui répond aux critères d’agrément canadiens et qui forme des diplômés qui seront des chefs de file dans leur milieu.

Les profils d’étudiants individualisés constituent l’une des nombreuses stratégies mises en place par le CNAQ pour tenter de fournir une approche axée sur l’apprenant. Les étudiants qui s’inscrivent au CNAQ arrivent avec un bagage unique et des aptitudes qui leur sont propres. Ils peuvent avoir besoin de préparation en mathématiques, en sciences ou en anglais, selon leurs études secondaires précédentes et les tests d’admission du collège. Un profil d’étudiant est un modèle de cours individualisé établi en fonction des besoins d’apprentissage et qui permet de maximiser le temps nécessaire à l’obtention du diplôme tout en prévoyant une charge de travail appropriée à chacun. C’est un plan souple qui favorise la participation de l’étudiant à des cours qui le mèneront au diplôme.


Le profil de l’étudiant est réévalué chaque semestre en vue de l’établissement du programme de cours du semestre suivant. Le responsable de la formation réexamine le profil de l’étudiant en sa compagnie et établit le plan des cours du prochain semestre. Les cours peuvent être suivis aussitôt ou reportés à un autre semestre en fonction des besoins, dans la mesure où les cours préalables ou concomitants sont suivis et que le programme se maintient dans certaines limites de durée. De cette façon, l’étudiant peut prendre part au choix de ses cours et les suivre à un rythme qui lui convient.

Le mentorat mis en place permet que chaque étudiant soit jumelé à un formateur dès son entrée au CNAQ de sorte qu’il puisse discuter de son profil et de tout ce qui peut influer sur ses études. Le mentor convoque une première rencontre servant à examiner le profil de l’étudiant créé à partir des notes des études secondaires et des tests d’admission. Les étudiants sont invités à un suivi au milieu du semestre et peuvent toujours s’adresser au formateur pour discuter de leur charge d’études, du contenu de leurs cours, de la présence au cours ou de toute autre question. Les mentors peuvent diriger les étudiants vers un conseiller, le Advanced Writing Center, les centres d’aide aux mathématiques ou au langage, le centre de soins infirmiers, le doyen ou toute autre ressource appropriée.

Le CNAQ offre plus d’une date d’admission de sorte que les étudiants peuvent entreprendre leurs études à l’automne, à l’hiver ou au printemps. Les semestres ont habituellement 15 semaines les périodes d’interruption étant de huit semaines. Pour ajouter à la flexibilité des profils étudiants individualisés, de nombreux cours de thérapie respiratoire sont offerts à l’automne et à l’hiver étant donné les 3 dates du début des semestres. De cette façon, les étudiants qui laissent un cours peuvent le reprendre au semestre suivant sans retarder la date de la fin de leur programme. Les étudiants sont invités à discuter de leurs difficultés avec leur mentor, leur conseiller, le responsable de la formation, le doyen ou le président de l’école des sciences de la santé, dans les cas où l’abandon d’un cours retardé le moment de l’obtention du diplôme. Lorsqu’un étudiant estime qu’il doit abandonner un cours, plusieurs avenues s’offrent à lui. Il peut consulter un conseiller de l’école qui pourra aborder avec lui la question de poursuivre ses études avec la même charge de travail tout en recevant de l’aide pour ses études, des conseils sur la façon de s’organiser ou sur des questions d’ordre personnel.

Cette façon d’établir le calendrier des cours exige une préparation rigoureuse. Le responsable de la formation du programme de thérapie respiratoire et le coordonnateur de la formation de l’école des sciences de la santé collaborent pour s’assurer que les cours sont assortis de façon à répondre aux besoins de l’étudiant à temps plein ou à temps partiel. Ils voient à ce que les cohortes d’étudiants forment des classes de taille optimale et qu’aucun étudiant ne soit seul dans une classe. C’est une tâche d’organisation immense, compte tenu de l’établissement manuel des horaires. En mars 2008, le CNAQ a commencé à utiliser des logiciels pour produire les profils étudiants et créer les horaires de plus de 2000 d’entre eux chaque semestre.

Le programme de thérapie respiratoire est un enseignement axé sur l’étudiant qui respecte les normes canadiennes d’enseignement. Un programme d’anglais de grande qualité couvrant aussi les matières du programme canadien fait en sorte que les diplômés du CNAQ ont les compétences nécessaires pour travailler dans tous les milieux du monde en pleine évolution. Le CNAQ offre un environnement dynamique et de nombreuses activités axées sur les étudiants. La personnalisation des profils étudiants offre à ceux-ci la flexibilité dans l’organisation de leurs cours et optimise le temps de leurs études.
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