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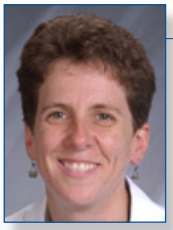
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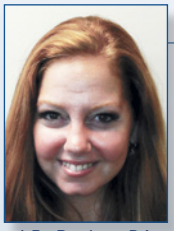
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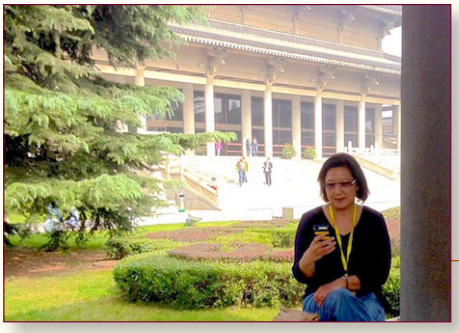

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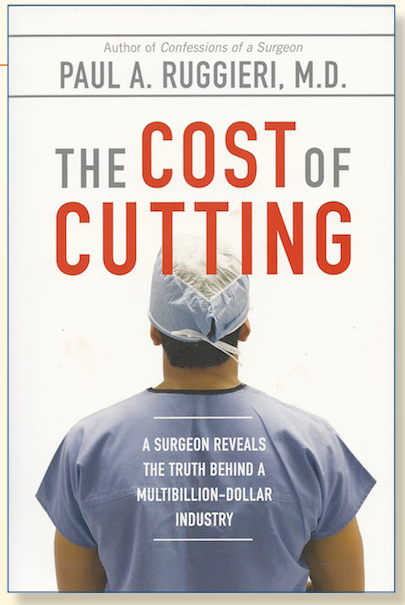

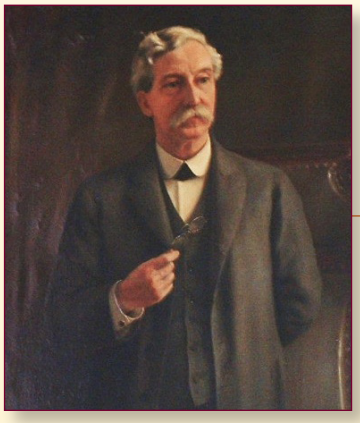

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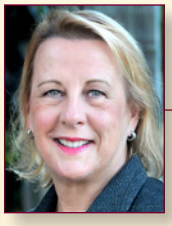

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We see the Journal as a vehicle aimed at the practicing physicians of Rhode Island – whether they are in private practice, on the staff of the state's hospitals or as part of the many colleges and universities of the state. It offers a venue for them to express their clinical or investigative findings, and for the academic faculty to publish their clinical or research results. It also serves as a platform for local medical students, resident physicians and fellows to contribute to the medical literature while honing the rudiments of medical writing.

In addition, it offers the opportunity for medical professionals to make the community aware of testing or clinical expertise that may not be widely known, even within our small state. And finally, RIMJ is a forum where allied health professions such as local schools of public health, pharmacy and nursing may share their concerns and aspirations as the business of health care takes on new and unanticipated challenges.

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'It's complicated'

JOSEPH H. FRIEDMAN, MD
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"IT'S COMPLICATED," HE SAID. "No, it's not," I thought, straining every neural circuit to keep from saying this aloud.

"It's never complicated," was the bubble coming out of my head as I appeared in my own cartoon.

I don't consider myself a very good listener, although, based on published data, I must be. In one published study of doctor-patient interactions, it was stated that, on average, patients spoke only about 17 seconds before the doctor interrupted them. I give patients a lot of time, measured even on a geological time scale, by my reckoning. During these times, the specialties of pathology and radiology beckon. Which is not to say I don't like listening. I love my patients. I really do, but less when they don't respect my time constraints, which means, really, that they don't respect the time due patients scheduled after them.

Many years ago a dermatology attending I knew told me that when he informed the residents that he didn't want to hear the patient's history, they thought he was joking. It took them a while to learn, he said, that when he told them he'd ask for the history if he thought he needed it, and otherwise just show him the skin lesion, that he really meant it.

My area of neurology is like dermatology in that way. Pattern recognition is the basis of most diagnoses. If a patient tells me he has a resting tremor, micrographia, slowed movements and a stooped posture, I will not conclude that he has anything wrong with him unless I see it. Movement disorders are not like epilepsy or headaches, where you don't see what you get. Rare movement disorders are paroxysmal and therefore are like epilepsy, but the paroxysms are usually long enough that they can be captured on smart phone videos. What you see is generally what you get, which is a very attractive aspect of this field.

So, this patient began having cognitive problems, but only for "complicated" topics, not the kind that would show up on the two-and-a-half-hour neuropsychology test he tested normal on. One toe turns bluish at times, indicating a circulatory problem; one limb twitches if he sits in a certain position for too long, and the mental clouding that occurs after walking, or standing too long, is very debilitating. It's difficult to restrain oneself from saying, "OK. It's really very simple. If I find something on your exam I'll more strongly consider the possibility that you have a neurological problem."

There are certainly patients with complicated problems. Usually it's because a lot of stuff has happened – a stroke, then a seizure, then a brain injury, then a tremor, or more than one organ system is involved – so that one must wonder if the blood dyscrasia caused the neurological problem or are they both part of the same disorder? Patients who see themselves as having complicated problems are generally extremely self-absorbed. Every twitch, every gurgle, every dropped object is a sign, and each sign requires recording as it may hold the key to the explanation of the unfolding biological phenomenon of this particular patient.

He did not want a test that might have revealed the diagnosis.

While there are many interesting aspects to the patient I'm referring to, perhaps the most interesting was the response to my discussion of a possible diagnosis, as I thought there really might be something "organic" wrong with the patient. He did not want a test that might have revealed the diagnosis. He was clearly bothered by his myriad symptoms, but not sure he wanted to take medication to treat them, and there would be no cure, hence why make a diagnosis if the condition was incurable? I don't blame him for preferring to let time make the diagnosis, with new identifying characteristics emerging slowly, as the syndrome progresses, if it

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is, in fact, a neurodegenerative disorder. I might well do the same. But I got the impression that he might actually prefer to see himself as a medical enigma, someone who baffled the experts or possibly was going to be labeled as having a psychogenic disorder, only to show the fools years later that he had really been suffering a clearly identifiable neurological problem. I don't know, of course. I wonder what the point of the exercise was. I took all of his symptoms seriously, but thought only a few were part of a medical problem, the rest being collections of the usual "funny" symptoms we all have, but somehow manage not to worry about. Did he actually want a diagnosis or did he want only a diagnosis if it was something not so serious? Or, did he really want to be told it was "all in his head?"

I don't expect him to return so I don't expect to find out. ❖

Author

Joseph H. Friedman, MD, is Editor-in-chief of the *Rhode Island Medical Journal*, Professor and the Chief of the Division of Movement Disorders, Department of Neurology at the Alpert Medical School of Brown University, chief of Butler Hospital's Movement Disorders Program and first recipient of the Stanley Aronson Chair in Neurodegenerative Disorders.

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The Ancient Roots of the Number Forty

STANLEY M. ARONSON, MD
smamd@cox.net

'Forty winks' comes readily to mind when seeking a cliché to define a brief afternoon nap. But why not 34, or better, 47 winks? Is there a physiological explanation for the insistence upon forty? Or is there some inherent quality in forty that ensures that it will readily come to a mind already distracted by other cliché-ridden numbers? Certainly in countless cultures, in the creation stories of many religions, and of course in countless legends, the number forty comes up with uncommon frequency.

Long before adult life had been newly discovered as "beginning at forty," well before the time when a civilized work-week was reduced to forty hours, certainly before forty acres and a mule were sufficient to provide a measure of security for a newly liberated slave, and millennia before a suitable punishment for minor sins was confined to forty lashes: before all of these, there were the many references to forty in the inaugural holy writings of some of the enduring religions.

At the Mesopotamian dawn of written civilization there was the Sumerian god known as Enki, patron deity of Eridu. He was identified, also, with other regional gods including the Babylonian, Nabu, and even Ea, lord of the earth in Akkadian cosmology. Enki's name, written in hieroglyphs spells the numeral, forty.

In the Hebrew Bible, we learn of Noah, the ark of salvation that he was instructed to build and the ensuing waters of the flood: "And the rain was upon the earth for forty days and forty nights." (Genesis 7:12)

The number, forty, reappears many times in the Hebraic Scriptures. Forty specifies the number of years that the Hebrew tribes survived in the Sinai desert. And Moses spent forty days and forty nights on the summit of Mount Sinai before receiving the Decalogue from the Lord. Both Solomon and David each ruled their nation for forty years. And Goliath taunted the Hebrews, twice daily, for forty days before David accepted his brash challenge. The prophet Elijah also endured the wilderness of Judah for forty days.

And in the New Testament, Jesus fasted forty days and forty nights in the Judean desert, thus resisting temptation for forty days. And forty days was the interval separating the resurrection and the ascension to heaven of Jesus.

Muhammad was forty years of age when he was visited by the archangel, Gabriel. Muhammad then prayed and fasted in isolation for forty days before his pilgrimage to spread the word of Islam beyond Mecca, accompanied now by forty followers. When one assists a blind person for forty steps, the Koran declares it to be an act of piety.

'And the rain was upon the earth for forty days and forty nights.' (Genesis 7:12)

Noah. Mosaic in Basilica di San Marco, Venice

Forty days – or forty years – thus became a widely employed interval for sanctifying a fast undertaken in solitude or a length of years embracing a lengthy interval of holy purpose. In the year 441 CE, for example, Saint Patrick, patron saint of Ireland, climbed a mountain in

County Mayo, now called Croagh Padraic (Patrick). Local tradition declares that the saint had invested forty days and forty nights in meditative prayer while fasting upon the summit of this mountain. And to this day many penitent pilgrims, often barefoot, struggle to the mountain's summit.

There is nothing singularly special about the number forty, neither to mathematicians, astronomers nor even astrologers. And to those who delve into the intricacies of numerology, it is of passing interest.

And so, one vainly searches in the domains of ancient literature, in pagan religions, in arcane realms such as Kabala, even in geophysical phenomenology for a hidden number forty. The elusive number forty, by mere happenstance thus emerges now and then as does any randomly chosen numeral. Even Schopenhauer (1788–1860), by religion an intractable skeptic, declared: "The first forty years of life give us the text; the next thirty supply the commentary."

The search for an incontrovertible meaning to forty, however, does disclose a biological reality that touches our origins as humans, whether we be deeply religious, spiritually indifferent or atheist: a normal, full-term pregnancy remains forty weeks in duration. ❖

Author

Stanley M. Aronson, MD, is Editor emeritus of the *Rhode Island Medical Journal* and dean emeritus of the Warren Alpert Medical School of Brown University.

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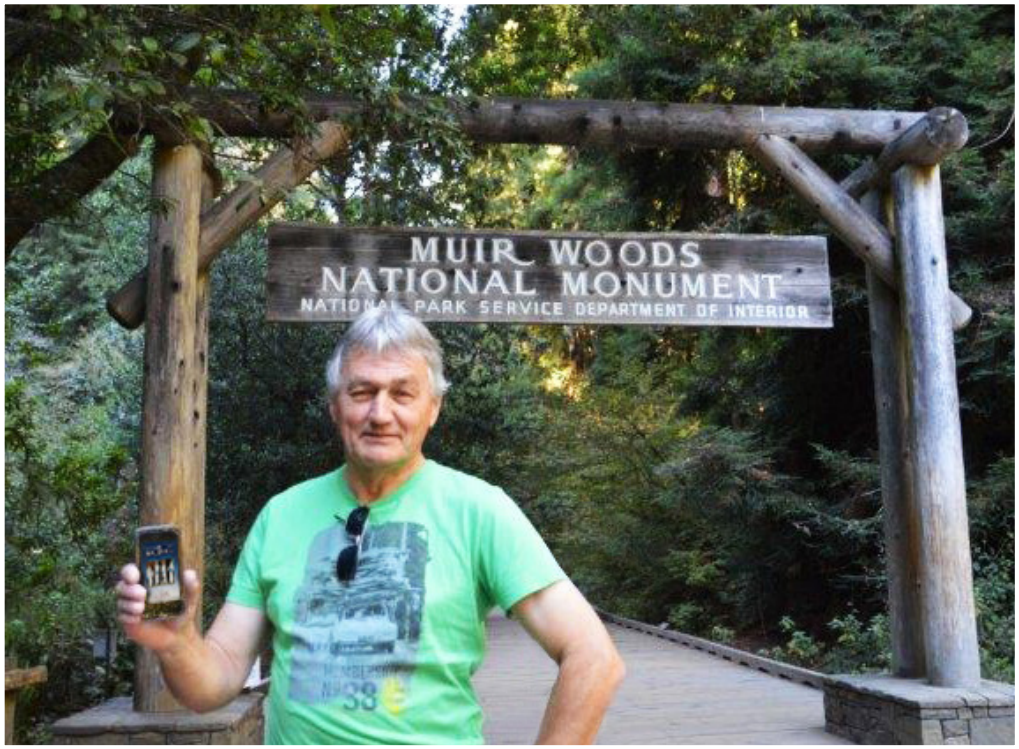
XI'AN, CHINA **Sheila Dai**, a psychologist from Warren, RI, and Cortland, NY, reviewed the October issue of the *Rhode Island Medical Journal* in front of the Shaanxi History Museum in Xi'an, China. Xi'an is located in the central/northwestern area of the country, and is the site of the famous Terracotta Warriors.

MILL VALLEY, CALIFORNIA
Roger Claessens, a vacationing chemical engineer from Berlaar, Belgium, accessed the October edition of the *Rhode Island Medical Journal* from Muir Woods National Monument.



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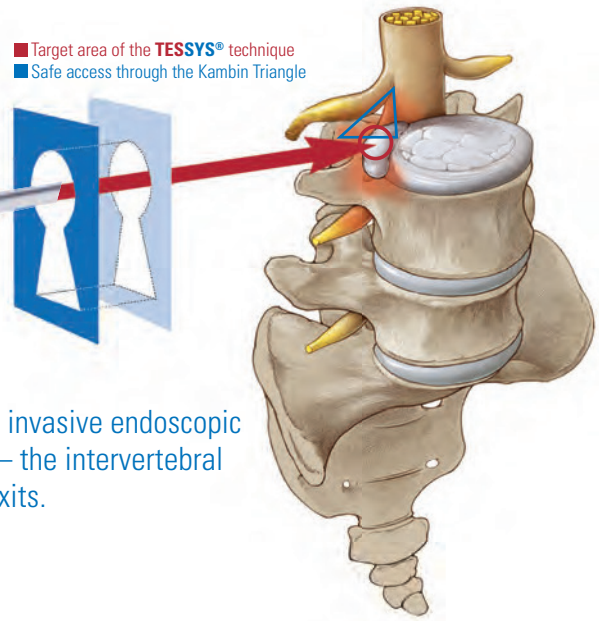

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Sports Medicine

ROY K. AARON, MD; JENNIFER R. RACINE, BA; ROBERT M. SHALVOY, MD
GUEST EDITORS

Athletic training and sports-related injuries can involve multiple organ systems. Examples include exercise-induced asthma, idiopathic hypertrophic subaortic stenosis (hypertrophic cardiomyopathy), and fluid and electrolyte imbalance. In this issue of the *Rhode Island Medical Journal*, we present examples of sports-related pathology reflecting multiple organ involvement. **"The Female Athlete Triad"** describes the effects of exercise on both the endocrine system and bone density. Female athletes are susceptible to menstrual dysfunction and loss of bone density associated with negative energy balance. Originally thought to occur in women with eating disorders, it is now recognized to occur with normal caloric intake in the face of excessive caloric demands of exercise.

"Exercise Induced Rhabdomyolysis" describes the syndrome of skeletal muscle breakdown associated with strenuous exercise. The clinical presentation consists of disproportionate muscle pain after exercise associated with elevated creatine phosphokinase. The mechanism seems to be related to cell membrane damage with intracellular influx of calcium and efflux of cellular breakdown products. In extreme cases, myoglobinuria and acute renal failure result.

Osteoarthritis (OA) following joint injuries in athletics (post-traumatic OA) is now recognized as a whole joint disease involving multiple tissues – cartilage, bone, ligament, capsule, and possibly having contributions from bone vasculature and inflammatory pathways. Anterior cruciate ligament tears are common causes of post-traumatic OA but most certainly involves trauma to other tissues in the joint that may be unrecognized at the time of injury.

"Post-traumatic Osteoarthritis after ACL Injury" discusses the contributions of bone and cartilage to joint damage and describes the mechanics of injury in pre-clinical models. Epidemiological and clinical research initiatives that may result in treatment programs are described.

Contemporary knee ligament reconstructions are assisted by intraoperative computer guidance for optimal graft placement and tension. **"Predicting Success in ACL Reconstruction"** describes the challenges of individualizing reconstructions and optimizing knee stability. The role of state-of-the-art computer navigation for the assessment and correction of the ACL injury is described along with the functional outcomes and return to sports of ACL-injured athletes.

Guest editors

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The Female Athlete Triad

ELIZABETH HORN, MD; NICOLE GERGEN, MD; KELLY A. McGARRY, MD, FACP

ABSTRACT

The female athlete triad is a spectrum of interrelated pathophysiologic consequences of low energy availability, menstrual dysfunction, and low bone mineral density. Components of the triad are not only counterproductive to athletic performance goals, but can lead to serious long-term negative health outcomes. Practitioners caring for female athletes play an important role detecting at-risk athletes early in their course along the disease spectrum. Importantly, women who are evaluated for one component of the triad should always be screened for the other two. Detecting the disorder early is the most important factor for preventing the potentially severe consequences, and requires heightened vigilance on the part of all those who work with this special patient population. In this article, we discuss the epidemiology, pathophysiology, diagnosis, evaluation, and management of the female athlete triad.

KEYWORDS: female athlete triad, menstrual dysfunction, disordered eating, altered bone density

INTRODUCTION

Female involvement in athletics and exercise has increased over recent decades. While exercise is encouraged for general health and disease prevention, female athletes are susceptible to negative health outcomes if energy balance is not maintained. Physicians should be familiar with the female athlete triad to enable proper evaluation, diagnosis, and management of the disorder.

DEFINITION

The female athlete triad is a spectrum of disease encompassing a broad set of disorders involving low energy availability, menstrual dysfunction, and low bone mineral density (BMD). First identified by the American College of Sports Medicine (ACSM) in 1992, the triad was initially characterized by disordered eating, amenorrhea, and osteoporosis. Since then, the nosology has been modified to reflect the disease continuum. The current definition reflects variable manifestations within each component of the triad. For example, negative energy balance can occur in athletes with average caloric intake but excessive energy expenditure, or in those with eating disorders. Menstrual dysfunction includes primary amenorrhea, secondary amenorrhea, and oligomenorrhea. Low BMD may manifest as an asymptomatic finding on dual-energy X-ray absorptiometry (DEXA) scan, stress fractures, or pathologic fractures. Fundamentally, the female athlete triad is a spectrum of three distinct pathophysiologic states with varied presentations.

EPIDEMIOLOGY

A recent review examining young women ages 17–25 years old who exercise suggested that the prevalence of all three components of the disorder ranged between 0-15.9%.[1] The wide prevalence estimates are due to several factors, including the changing definition of the female athlete triad, variance in prevalence between types of athletes, as well as inherent diagnostic challenges. It is uncommon for all components of the triad to be diagnosed in concert. Rather, women afflicted with the female athlete triad evolve symptoms and features of the syndrome along non-congruent disease continuums for each component of the triad. Women participating in "lean sports" which assign aesthetic value to performance including gymnastics, ballet dancing, and ice skating are at higher risk for developing the female athlete triad. Studies comparing lean-sport athletes versus non-lean sport athletes demonstrated a prevalence of all three components of the female athlete triad in up to 6.7% of lean-sport athletes compared to 2.0% of non-lean sport athletes.[1]

Epidemiological data exist for components of the female athlete triad. Negative energy balance is the primary disorder in the female athlete triad driving menstrual dysregulation and low BMD. Low energy availability can occur in the setting of both caloric restriction and excessive exercise. In the general adolescent female population, the prevalence of disordered eating is estimated between 13-20%.[2,3] By contrast, between 15% and 62% of female high school and college athletes exhibit disordered eating, but it is unclear how many have clinical eating disorders or low energy availability leading to triad sequelae. Menstrual dysfunction manifesting as secondary amenorrhea is reported as high as 69% prevalence in female athletes who participate in lean sports compared with 5% of the general population.[4] The prevalence of low BMD is difficult to define in the female athlete population as most young women are not candidates

for BMD testing. Some studies estimate the prevalence of low bone density in female athletes is as high as 13% compared to 2.3% in the general adult population.[4] Despite lack of epidemiologic clarity, the association between these three disorders is well established, meriting evaluation of all components of the triad when one disorder is identified.

Pathophysiology: Low Energy Availability

Low energy availability, defined as insufficient energy to supply metabolic demand, is the primary disorder driving pathophysiologic changes in the female athlete triad. Negative energy balance results in insufficient metabolic supply for normal menstrual function, bone development, and bone maintenance. Factors dictating energy availability include caloric intake, baseline metabolic function, and energy expenditure.

Female athletes may maintain adequate nutrition for average caloric requirements but rigorous training demands contribute to caloric deficit. Alternatively, maladaptive dietary habits such as restriction, purging, laxative, stimulant and diuretic use may lead to insufficient energy availability. When evaluating the female athlete triad, it is important to distinguish between excessive energy expenditure for caloric intake, disordered eating, and a clinically defined eating disorder, the latter of which would necessitate psychiatric evaluation.

ACSM Information On...

The Female Athlete Triad

The Female Athlete Triad is a health concern for active women and girls who are driven to excel in sports. It involves three distinct and interrelated conditions: disordered eating (a range of poor nutritional behaviors), amenorrhea (irregular or absent menstrual periods) and osteoporosis (low bone mass and microarchitectural deterioration, which leads to weak bones and risk of fracture).

A COMPLETE PHYSICAL ACTIVITY PROGRAM
A well-rounded physical activity program includes aerobic exercise and strength training exercise, but not necessarily in the same session. This blend helps maintain or improve cardiorespiratory and muscular fitness and overall health and function. Regular physical activity will provide more health benefits than sporadic, high intensity workouts, so choose exercises you are likely to enjoy and that you can incorporate into your schedule.

ACSM's physical activity recommendations for healthy adults, updated in 2011, recommend at least 30 minutes of moderate-intensity physical activity (working hard enough to break a sweat, but still able to carry on a conversation) five days per week, or 20 minutes of more vigorous activity three days per week. Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation.

Examples of typical aerobic exercises are:
- Walking
- Running
- Stair climbing
- Cycling
- Rowing
- Cross country skiing
- Swimming.

In addition, strength training should be performed a minimum of two days each week, with 8-12 repetitions of 8-10 different exercises that target all major muscle groups. This type of training can be accomplished using body weight, resistance bands, free weights, medicine balls or weight machines.

FEMALE ATHLETE TRIAD CAUSES
Exercise alone does not put someone at risk for developing the Triad; however, an energy deficit, in which caloric intake doesn't match energy expenditure, is a risk factor.

All women face societal pressure that "thin is in." A young woman or girl who is determined to achieve a lean appearance or athletic success may attempt to excel through compulsive dieting and exercise. (Such athletes are typically goal-oriented perfectionists.) This misguided approach may lead to disordered eating, menstrual dysfunction and lower-than-normal bone mass formation.

WHO IS AFFECTED?
Anyone may be affected, but women and girls participating in activities which emphasize leanness are at especially high risk. These activities can include:
- Gymnastics
- Ballet
- Diving
- Figure skating
- Aerobics
- Running

Weight class sports associated with disordered eating in athletes, including males, are:
- Wrestling
- Rowing
- Martial arts

DISORDERED EATING
In response to pressure to lose weight, women and girls may practice unhealthy weight-control methods, including restricted food intake, self-induced vomiting, consumption of appetite suppressants and diet pills, and use of laxatives and compounds to increase urination. Specific eating disorders are anorexia nervosa and bulimia.

Many girls and women hide or deny their eating disorders due to embarrassment, shame, fear of losing control of their dieting and a mistaken believe that excessive weight loss enhances performance.

WARNING SIGNS OF EATING DISORDERS
- Excessive leanness or rapid weight loss;
- Preoccupation with weight, food, mealtime rituals and body image;
- Avoiding team meals, or secretive eating;
- Wide fluctuations in weight;

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http://www.acsm.org/docs/brochures/the-female-athlete-triad.pdf

Pathophysiology: Menstrual Dysfunction

Menstrual dysfunction may present as primary amenorrhea, secondary amenorrhea, or oligomenorrhea. Primary amenorrhea is the absence of menses at age 15 in the presence of normal growth and secondary sexual characteristics or the absence of menses three years after development of secondary sexual characteristics. Secondary amenorrhea is the absence of menses for more than three cycles or six months in women who previously had regular menses, or the absence of menses for more than nine months in women who previously had irregular menses. Oligomenorrhea is defined as menstrual cycles >35 days apart. Because eumenorrhea may not be established until late in adolescence or early adulthood, menstrual dysfunction may be difficult to establish. When a female athlete develops negative energy balance and subsequent hypometabolic state, hypothalamic GnRH pulsatility is altered.[5] Hypothalamic dysfunction leads to anovulation and subsequent menstrual disturbances.[6]

Pathophysiology: Altered Bone Mineral Density

Bone health is maintained through a continuous process of balanced osteoblastic and osteoclastic activity. In females with a negative energy balance, altered GnRH pulsatility suppresses the hypothalamic-pituitary axis and results in a hypoestrogenic state. In healthy menstruating females, estrogen suppresses osteoclastic activity, promoting bone development and normal BMD. Thus, low BMD in women with the female athlete triad is secondary to the lack of adequate estrogen supply for optimal bone health. Women with menstrual dysfunction and low estrogen can lose up to 2% of BMD annually.[7] Rigorous athletic activity alters the development and maintenance of bone health in preferential anatomic locations.[8] In female athletes, sport activity may increase density of weight bearing bones such as the femur while other bones, including the spine may demonstrate altered BMD. Pathologic and stress fractures should prompt clinical evaluation for the female athlete triad.

DIAGNOSTIC EVALUATION: THE FEMALE ATHLETE TRIAD

Primary care providers play an integral role in the diagnosis of the triad. Identifying at-risk athletes optimally occurs during academic and sports related screenings or in the setting of office visits for menstrual dysfunction, pathologic or stress fractures or disordered eating. Ideally, parents and athletic trainers should be able to recognize components of the female athlete triad and its negative health consequences.

Assessing Low Energy Availability

Evaluation of energy state is essential in evaluating a patient for the female athlete triad. Important historical aspects include dietary habits (current and past), highest and lowest weight, and perception of ideal body weight. Patients should be assessed for disordered eating including restriction,

purging, and use of diuretics, laxatives, or stimulants. Activity level should be determined by evaluating duration and intensity of daily exercise and sports involvement. Examination should include measurement of orthostatic vital signs assessing for resting tachycardia and volume depletion, weight, and BMI. It is important to note findings suggestive of eating disorders including lanugo, parotid gland enlargement, dental enamel erosions and knuckle calluses caused by self-induced vomiting. Laboratory evaluation should include complete blood counts, complete metabolic profile, thyroid function tests and urinalysis. If electrolyte abnormalities are present or the patient presents with bradycardia, an EKG should be performed to assess for arrhythmia or prolonged QT interval.

Menstrual Dysfunction

The ACSM recommends screening for the triad in any female athlete with a total of six months of amenorrhea or oligomenorrhea.[9] When evaluating a patient for menstrual dysfunction, providers should ask about age at menarche, frequency and duration of menstrual cycles, last menstrual period, and medication use including oral contraceptives. Careful examination of the patient with a focus on secondary sexual characteristics, signs of hyperandrogenism or findings suggestive of thyroid dysfunction may help distinguish other causes of menstrual dysfunction from altered GnRH pulsatility seen in the female athlete triad. The first step in laboratory evaluation is a pregnancy test. Subsequent work up may include evaluation for polycystic ovarian syndrome, thyroid or pituitary abnormalities. Drugs which affect the menstrual cycle such as contraceptives, antipsychotics or thyroid medications should be identified. Depending on the clinical scenario, evaluation of follicle stimulating hormone (FSH), leutinizing hormone (LH) and possibly MRI evaluation for a pituitary process may be indicated. Importantly, hypothalamic amenorrhea due to decreased GnRH pulsatility seen in the female athlete triad is a diagnosis of exclusion.[5]

Altered Bone Mineral Density

Altered BMD may present as abnormal bone development, osteopenia, and osteoporosis. Initial evaluation should include obtaining a history of stress fractures, overuse injuries, and pathologic fractures. A careful assessment of ovulatory status should be performed. The evaluation of BMD can be difficult in the female athlete given continued bone development in adolescence. Osteoporosis can be evaluated with DEXA scanning using the T-score or the Z-score. The T-score compares BMD to a thirty year old adult control whereas the Z-score compares BMD to age and gender matched controls. The latter is a more appropriate diagnostic method for female athletes who have yet to achieve maximum bone density. Evaluation of osteoporosis in the young female athlete is further complicated by site dependent alteration in BMD as discussed previously.

TREATMENT CONSIDERATIONS

Low Energy State

Due to increased caloric requirements of female athletes, nutritional support and dietary counseling are integral to the treatment of these patients, regardless of the presence or absence of disordered eating. The ACSM recommends establishing weight goals in writing in order to continue athletic participation.[9] Realistic training goals should be identified. Additionally, the organization recommends a nutrition education program, stress reduction, and consideration of bone densitometry screening. If there is concern for an eating disorder, referral to a mental health specialist is appropriate.

Menstrual Dysfunction

While a weight or energy requirement goal for the resumption of eumenorrhea has not been definitively established, one study found that restoration of eumenorrhea in anorexia nervosa patients required weight gain of 2 kilograms over the weight at which secondary amenorrhea occurred.[10] Patients who wish to become pregnant require special consideration. While normalization of menstrual cycle and ovulation can be attained by increasing energy availability, weight gain, and subsequent normal pulsatile GnRH activity, other endocrinologic interventions are available and may be necessary but are beyond the scope of this article.

Altered Bone Mineral Density

The ACSM recommends consideration of DEXA screening in at risk patients.[9] Resolving the low-energy state is the optimal treatment for altered BMD. A variety of therapies have been proposed. Bisphosphonates are used for the treatment of osteoporosis in post-menopausal women and have been considered in this disorder. Their effectiveness has yet to be demonstrated in premenopausal women. Human trials have not established bisphosphonate teratogenicity but animal trials have shown adverse effects on the fetus. A reasonable pharmacologic approach to bone health supplementation in the female athlete includes vitamin D (400–1000 IU/day) and calcium (1300 mg/day).[9]

FUTURE RESEARCH

Future directions will include a focus on examining the role of hormone replacement in re-establishment of menstruation and normal BMD. Oral contraceptive pills have been used to treat adolescents with menstrual dysfunction from other causes, but their use has not been adequately studied in the female athlete population. Initial data in female athletes is mixed with respect to the effect of oral contraceptive pills on bone health.[11] Transdermal estrogen is also an emerging area of research interest. It is thought that transdermal preparations of estrogen may be preferable to oral contraceptive pills in that they have less of an inhibitory effect on insulin-like growth factor-1, a trophic hormone that has been shown to promote bone formation.[4,12] In

postmenopausal women, transdermal estrogen has reduced fracture risk, but its potential benefits and harms have not been well studied in the young female athlete population.

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Exercise-Induced Rhabdomyolysis

GEORGE LEE, MD

ABSTRACT

Exercise-induced rhabdomyolysis, or exertional rhabdomyolysis (ER), is a clinical entity typically considered when someone presents with muscle stiffness, swelling, and pain out of proportion to the expected fatigue post exercise. The diagnosis is confirmed by myoglobinuria, and an elevated serum Creatinine Phosphokinase (CPK) level, usually 10 times the normal range. However, an elevation in CPK is seen in most forms of strenuous exercise, up to 20 times the upper normal range. Therefore, there is no definitive pathologic CPK cut-off. Fortunately the dreaded complication of acute renal failure is rare compared to other forms rhabdomyolysis. We review the risks, diagnosis, clinical course and treatment for exercise-induced rhabdomyolysis.

KEYWORDS: exertional rhabdomyolysis, CPK, myoglobinuria, acute renal failure

INTRODUCTION

Rhabdomyolysis (RM) is a condition of striated muscle damage, usually in conjunction with an elevation in creatine phosphokinase (CPK). The mechanism involves either trauma or intracellular depletion of ATP leading to intracellular influx of calcium. This in turn results in the disruption of the cell membrane, and subsequent release of intracellular contents into the plasma and extracellular space. It is this translocation of intracellular debris that can potentially lead to serious complications, most notably acute renal failure (ARF). The incidence of acute renal failure complicating RM ranges from 15-50%. The most common causes of RM with resultant acute renal failure include ischemia, drugs, alcohol and trauma. Melli[1] reported 475 hospitalized patients with RM at John Hopkins. Exogenous toxins, including illicit drugs, alcohol and medications were the most common cause, with an incidence of acute renal failure being 46%.

The incidence of exercise-induced or exertional rhabdomyolysis (ER) in the general public is difficult to define, as many patients probably do not seek medical attention. However, data have been accrued from military recruits undergoing basic training. Wildly ranging rates have been described, due to the varying definitions utilized. The largest data set was by Hill,[2] who reported, in a retrospective review of 574,688 U.S. Army soldiers, 1203 cases of ER or 0.2%. This translates to a yearly rate of 7-8 cases/10,000. Rates were higher men vs. women. Olerud et al,[3] using serum myoglobin as a screening test, diagnosed ER in 40% of military recruits within the first 6 days of basic training.

DIAGNOSIS

The varying rate of ER is due to the nebulous diagnostic criteria. Clinically it can manifest itself with prolonged muscle swelling and tenderness, lasting several days longer than expected. Ensuing dark urine may develop, signifying myoglobinuria. Elevation of CPK is one of the main serologic criteria to define the entity. However, there is no defining set point in the height of the CPK rise to identify clinically relevant EH. A confounding factor is that CPK elevation after strenuous activity is quite common, with the range being quite variable. Thus, no normal post-exercise CPK value has been established. Studies in male marathoners[4] and triathletes have demonstrated, 24 hours after race completion, CPK elevation in the several thousand range, 10-20 times the upper limit of normal. Of the exercises associated with ER, downhill running and those that induce eccentric (muscle lengthening) contractions tend to be more commonly identified. Examples would include squat thrusts, pushups, and biceps curls. Clarkson[5] measured CPK in 203 healthy, but relatively physically inactive college students after 2 sets of elbow curls with weights for 25 repetitions. Mean CPK rose to a peak of 7713 at day 4, with a range of 50-80,550. The enzyme elevation lasted until day 10 post exercise. No participant developed any medical complications. ER has also been reported in a host of other physical activities including spinning, rock climbing, ice skating, and swimming. A common thread seen in ER is continued exertion beyond the point of fatigue. This is typically seen in a group setting, where peer pressure plays a role, or under the supervision of a demanding personal trainer.

RISK FACTORS

Asides from the type and duration of exercise, several other risks factors are associated with ER. Studies have shown that at baseline and post exercise, elevations in CPK are greater in men vs. women. Also CPK increments are greater in blacks vs. Caucasians.[2,11] Increased muscle mass is thought to

explain the gender difference.[4] The ethnic difference explanation is more elusive. One entertained mechanism is the prevalence of sickle cell trait, which may lead to an exaggerated raise in post exercise CPK.[13] Another potential risk is any factor that may hamper bodily heat release. Drugs, particularly amphetamines, are implicated, as they cause peripheral vasoconstriction. Concordant with this hypothesis, is the fact that history of heat stroke may also be another predisposing factor. This was noted in a retrospective review by Hill in the military recruits. As a result, rubber suits, used by wrestlers to lose water weight have been banned. If ER is recurrent in an otherwise healthy, young patient, inherited muscle enzyme defects should be considered. The most common include carnitine palmitoyl transferase deficiency, myophosphorylase deficiency (McArdle's disease) and adenosine monophosphate deaminase deficiency.

COMPLICATIONS

The serious complications of RM include ARF, hyperkalemia, DIC and compartment syndrome. Fortunately, these are all rare with ER. This is most likely due to the fact many of these patients are relatively young and healthy. If acute renal failure develops from ER, full renal recovery is nearly universal. Sinert[6] reported 35 ED admissions for ER with a mean CPK of 40,471. No patient developed acute kidney injury. Hill's[2] data reported an incidence of 8% in the 1203 cases of EH, all of whom recovered renal function.

One question frequently asked is, what level of CPK is associated with kidney injury? Although those who develop renal damage tend to have a higher CPK levels, the correlation between peak of CPK rise and acute renal failure is poor. Some studies have suggested renal injury is associated with CPK in excess of 20,000. However, there are also case reports of it occurring at 5,000.[8] Complicating the issue is that there are frequently other contributing factors to renal damage in those studies. Meijer[7] reported the clinical course of 26 ICU admissions with severe RM, defined as CPK >10,000. The most common causes were ischemic and trauma, none due to exercise. Those who developed acute renal failure had a mean peak CPK of 55,366 vs. 28,643. However, there was substantial overlap between the 2 groups, and no defining level could be ascertained. Therefore, no CPK level has been established in the literature to predict ARF.

ARF from RM is the most serious complication that physicians are attuned to. It was first described in the medical literature in the 1940s by Beall and Bywater.[12] They reported uremic deaths several days following crush injuries due to bombing raids in London. The mechanism of kidney injury is several-fold. Myoglobin, the heme-based oxygen carrying component in muscle is released into the circulation. It is believed to be toxic to the renal tubules. Secondly, there is a period of renal vasoconstriction hampering perfusion. Lastly, there can be severe third spacing with fluid being sequestered into damaged muscle, leading to an effectively pre-renal condition. Due to the last mechanism, vigorous isotonic intravenous fluids have been the hallmark of preventive therapy. Volumes suggested range from 6-10 liters over the first 24 hours to maintain a urine output of 200-300ml/hour. The earlier the fluid administration, the better, a conclusion Ori Better[9] reported in crush victims from a collapsed building. However, therapy needs to be individualized, with close attention paid to the patient's volume status. IVF administration to the point of overt fluid overload has been associated with increased mortality in ICU patients.

TREATMENT

The issue of type of intravenous fluid is still debated. Although urinary alkalinization can increase the solubility of myoglobin, the superiority of bicarbonate containing solutions over saline has not been confirmed. The same holds true for mannitol, another agent frequently employed to prevent and treat RM-associated ARF. In a retrospective review of 74 cases of kidney injury due to trauma-induced RM, Brown[8] found no benefit with mannitol or bicarbonate solution. In addition, there is a risk of osmotic induced tubular injury with mannitol adminstration. A serum osmolar gap >50 can predispose to this untoward complication.

Hypothetically, extracorporeal removal of myoglobin can be beneficial. Due to the size of the heme protein, it is not removed with conventional hemodialysis. However, plasmapharesis[10] can effectively extract the compound from the vascular space. High flux continuous hemofiltration also can remove it as well. Regardless, there are no randomized studies that establish either modality as a preventative measure or treatment for ARF. Thus neither can be recommended.

SUMMARY

A post-exercise CPK rise is a common phenomenon. The defining line from a normal physiologic response to a disease state is a blurry one. When complications are initially apparent, then the distinction is obvious, but frequently, they are not present. Avoidance of alcohol, amphetamine-based drugs and the gradual increments in exercise intensity are recommended to attenuate ER. One issue is when to admit patients. Acute renal failure is quite rare and when it does occur, it almost always resolves completely. Therefore, in the absence of serious complications, the decision to admit is generally intuition based. CPK tends to peak at day 4, but can remain elevated for 1-2 weeks. If a patient presents without evidence of ARF, it would be unlikely to develop after generous IV isotonic fluid administration. Rate and volume of fluid needs to be individualized and clinically-based.

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Post-Traumatic Osteoarthritis after ACL Injury

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ABSTRACT

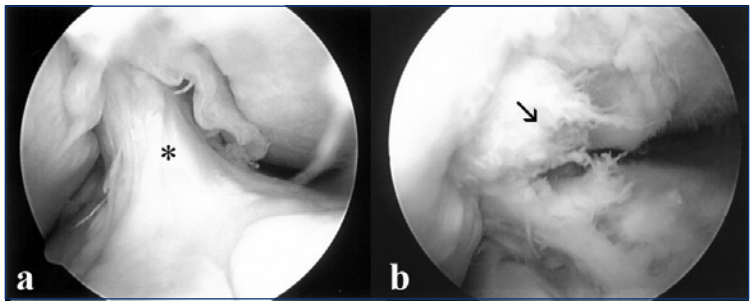
Post-traumatic osteoarthritis (PTOA) occurs as a consequence of joint trauma or occupations or sports that subject joints to excessive loading stresses. Ligament injuries to the knee, particularly tears of the anterior cruciate ligament (ACL), often result in PTOA. Approximately half of the individuals with an ACL injury develop PTOA regardless of the reconstruction of the torn ligament. This observation has raised the possibility that other injuries occur to the knee in association with ACL tears that may involve ligamentous capsular structures, articular cartilage, or subchondral bone. Many ACL injuries occur in noncontact sports and are the result of biomechanical abnormalities. Female athletes are more likely than their male counterparts to suffer ACL injuries. This review outlines the epidemiology of ACL tears, its pathology in cartilage and bone, some of the demographic, biomechanical, and neuromuscular factors involved in ACL tears, and PTOA and important information gained from preclinical injury models.

KEYWORDS: Osteoarthritis, Ligament Injury, Arthroscopy

INTRODUCTION

Post-traumatic osteoarthritis (PTOA) often follows joint fractures and dislocations, ligament and cartilage injuries, and chronic ligament instability among other traumatic affections of joints, and occupations or sports that subject joints to high levels of impact and torsional loading. Individuals experiencing significant ligamentous-capsular or meniscal injuries to the knee have a 10-fold increased risk of PTOA compared to uninjured persons.[1] The commonest ligament injury to the knee resulting in PTOA is tear of the anterior cruciate ligament (ACL) (**Figure 1**). Athletes, from recreational to professional levels are more likely to suffer from an ACL injury, which in turn, can lead to a discontinuation of their athletic activity, career, and costly medical expenses. It has been reported that knee injuries account for 60% of all sports-related surgeries, while 50% of those knee injuries are ACL related.[2] This is a particularly troubling etiologic association because it commonly occurs in a young population and places them at high risk for PTOA. Between 100,000 and 400,000 ACL injuries occur annually in the United States with 100,000 ACL reconstructive procedures performed each year. Approximately 50% of individuals with an ACL injury develop PTOA 10-15 years after injury regardless of treatment of the ligament injury.[3]

Figure 1. a.) Intact ACL (asterisk), b.) Torn ACL (arrow)

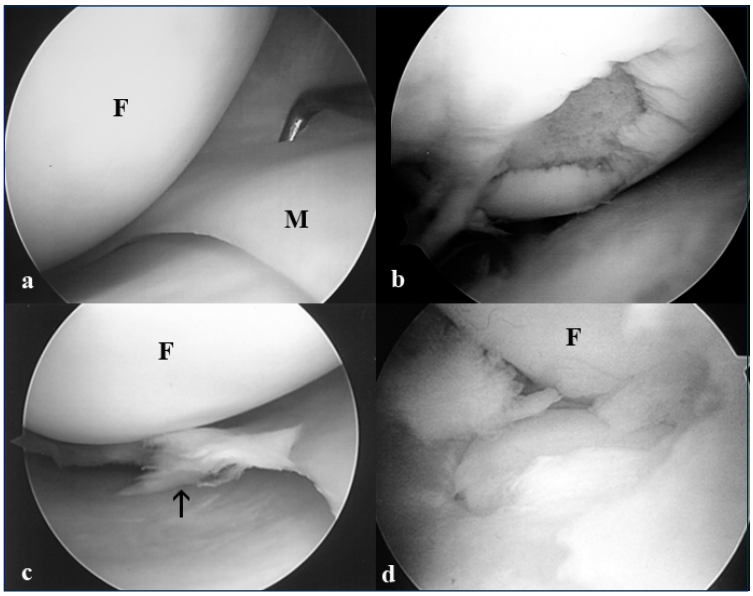


ACL TEARS

Reconstruction of the ACL, while providing stability for daily activities and sports, does not prevent the later onset of PTOA, raising the issue of unrecognized injuries to articular cartilage and subchondral bone occurring at the time of injury and contributing to joint breakdown.[1, 4] Several studies have shown that coincident blunt impaction injury to articular cartilage and subchondral bone together with ACL disruption are associated with PTOA.[5] In all likelihood, both types of injuries frequently occur together, and injury to cartilage or subchondral bone may occur at the time of ACL tear not but be apparent to the clinician at the time of injury.

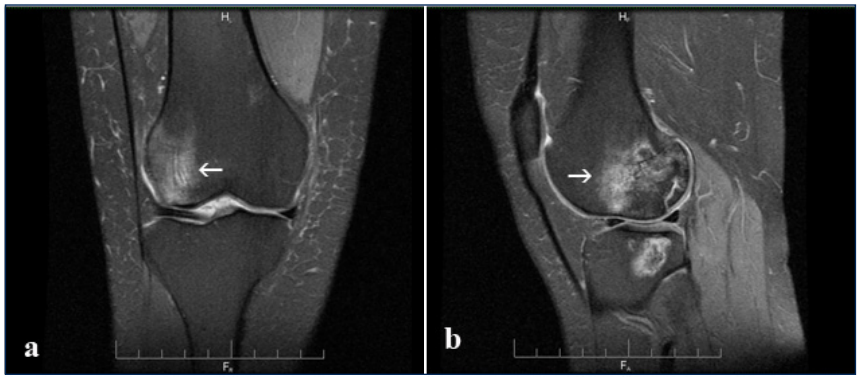
In a 14-year follow-up study of 205 male athletes with ACL tears, 78% had degenerative signs in their injured knee compared to 4% in their uninjured knee.[4] These findings were confirmed by a study that found that the incidence of chondropathy determined by MRI was 92-94%.[6] A significant decrease in the delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) index, reflecting loss of cartilage extracellular matrix (aggrecan) in ACL-injured knees, has been demonstrated. Considered together, these data suggest that chondral injury co-exists with ACL injury and contributes to PTOA. **Figure 2** displays types of cartilage injuries that occur with ACL tears including meniscal tears, debris synovitis, cartilage damage, and injury to the subchondral bone. It appears that, irrespective of surgical treatment, patients with ACL injuries develop PTOA for reasons that are poorly understood.

Figure 2. a.) Arthroscopic view of a normal joint showing femoral condyle (F) and meniscus (M); 4mm probe is located at the menisco-capsular junction. b.) Traumatic cartilage lesion in the femoral condyle. c.) Meniscal tear (arrow). d.) Cartilage debris associated with synovial inflammation.



Several studies have demonstrated impaction injuries of cartilage and subchondral bone with ACL tears, some severe enough to cause fracture and bone marrow edema persisting for up to one year in 60% of injured knees.[7, 8] Bone marrow edema, termed by some "bone marrow lesions," can occur in more than 80% of cases of ACL injuries.[9] Recent studies have shown that subchondral bone marrow edema lesions are associated with pain and progression of cartilage degradation.[10] Bone marrow edema is characterized by high signal intensity on T2 sequences of MRI images (**Figure 3**). Histologically, bone marrow edema lesions are distinguished by marrow necrosis, abnormal trabeculae and reduced mineral density. Some studies have shown intraosseous hypertension. **Figure 2** presents a typical appearance of bone marrow lesions. Certainly there is suggestive clinical evidence that occult bone lesions occur with ACL injury and contribute to PTOA.

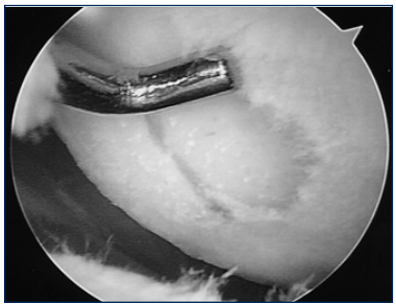
Figure 3. T2 MRI sequence demonstrating bone marrow edema lesions (arrows) on (a) coronal and (b) sagittal views.



Pathology of Articular Cartilage

Pathologic changes in articular cartilage extracellular matrix and chondrocytes have been described within 48 hours after impaction trauma consisting of loss of extracellular matrix molecules, fibrillation, fissuring, clefting, chondrocyte cloning, vascular violation of the tide mark, loss of lubricin, damage to collagen, and are proportional to the extent of impact energy. Cellular changes include apoptosis and cell death. *In vitro* models confirm the presence of chondrocyte necrosis and apoptosis initiated at a load of approximately 25 megapascal (MPa) Lower loads do not produce structural damage, but do produce cell death indicating that chondrocyte necrosis can precede structural damage with loads as low as 3MPa.[11] Lower levels of repetitive compressive injuries can accumulate enough degradative changes over time to cause reductions in mechanical properties similar to higher levels of injury by up-regulating the synthesis of matrix degrading enzymes.[5] End stage PTOA is characterized by loss of articular cartilage and exposure of subchondral bone (**Figure 4**).

Figure 4. Arthroscopic view of focal articular cartilage loss to subchondral bone. The probe has a 4mm angled tip indicating a lesion size of approximately 4x 10mm.



Pathophysiology of Subchondral Bone

Understanding the role of subchondral bone in the pathophysiology of PTOA remains elusive. In particular, the role of the osteoblasts in subchondral bone remodeling and cartilage breakdown remains unclear, as does the significance of recent descriptions of bone marrow edema and altered perfusion. Osteoblasts alter their cytokine expression profile in response to their physicochemical environment and changes in the physical environment in subchondral bone in PTOA are well within the range in which osteoblasts are sensitive. Intraosseous hypertension produced experimentally by venous ligation results in the histopathological hallmarks of PTOA – focal avascular necrosis (AVN), trabecular remodeling, thickening of the subchondral bone plate, endosteal and periosteal new bone formation and sclerosis.[12] Several observations have suggested that intraosseous hypertension is caused by increased venous resistance resulting in outflow obstruction and venous stasis. The pathophysiological consequences of intraosseous hypertension may lie in its association with diminished perfusion and hypoxia which could serve as parts of a signaling complex to osteoblasts.[13] Osteoblasts are responsive to hypoxia and this may be involved in mechanotransduction pathways. Osteoblasts subjected to hypoxic conditions with pO_2 of 35-40mmHg, markedly alter the expression

profile of growth factors associated with the pathologic findings of OA, increased bone remodeling and cartilage degradation. Osteoblasts derived from OA bone also express high levels of alkaline phosphatase, osteocalcin, and IGF-1 which are related to bone remodeling.

BIOMECHANICAL AND NEUROMUSCULAR FACTORS IN ACL TEARS

Sports medicine researchers and clinicians have focused on biomechanical risk factors for injuries and preventative measures. Studies have examined *extrinsic* risk factors including the level of sport (training versus competition), shoe type, and playing surface, and *intrinsic* risk factors such as age, gender, and even hormonal status. The most frequent mechanisms of ACL injuries in sports, almost 70%, are non-contact.[14] Non-contact ACL injuries include stopping mid-stride to respond to an opponent's change in direction, especially in soccer, and an increase in loading from jumping, such as in basketball. Studies of neuromuscular and biomechanical factors have shown that many ACL injuries are not the results of contact and that distinct biomechanical patterns such as excessive coronal plane motion, less knee flexion, and landing flatfooted are associated with ACL injury.[15] These observations suggest that ACL injuries, especially in females, are primarily neuromuscular and biomechanical in nature and subject to modification.

Female athletes in particular, are more likely to incur ACL injuries than are male athletes. Over the past two decades there has been a marked increase in ACL injuries in young female athletes in sports that involve cutting, jumping, and pivoting.[15] One study looked at the effect of gender on injury rates among military recruits during basic training (n=861) and found that women had twice as many injuries as men (relative risk = 2.1, 95% CI =1.78 to 2.5).[16] Another study looked at ACL injuries among male and female recruits playing intercollegiate sports, coed intramural sports, and military training, and found a combined relative risk of 2.44 for women compared with men.[17] This has been ascribed to increased valgus movements during landing, hormone levels, narrower intercondylar notch width, and smaller AC ligaments.[14,18] Neuromuscular training programs suggest that enhancing body control may decrease ACL injuries in women.[14] It has been found that male athletes attenuate knee ligament stresses during jumping by knee flexion and absorption of strain by the quadriceps. By contrast, female athletes have been found to land with the knee relatively straighter with more stress taken up by the ACL. These relatively higher stresses are believed to contribute to ACL injuries. Programs have been devised to train female athletes to attenuate more stress with their quadriceps, thus reducing load, and hopefully injury, to the ACL. Prevention programs that involve proprioception, plyometrics, strength training, and improved jumping, stopping, and turning techniques are showing promising results.[18] With this type of training, female athletes have been shown to reduce coronal plane motion, exert more muscular control, and reduce ACL stresses during movements such as jumping, landing, pivoting, and deceleration.

PRECLINICAL INJURY MODELS

Preclinical injury models are useful for several reasons; 1.) Human tissue is unavailable for study except in end-stage PTOA, 2.) Dosimetry of impact can be determined and related to pathological changes in cartilage and bone, 3.) Sequential histopathological examinations of joints can reveal the time course and magnitude of progressive development of PTOA. The fracture threshold for the femoral condyle in rabbits has been reported to be about 120MPa and most direct impaction injury studies have used magnitudes between 20-50MPa to produce chondrocyte death and loss of extracellular matrix integrity Models of impaction injury to cartilage and bone have been established in rabbits, dogs, and sheep *in vivo*, as well as *in vitro* explants and changes typical of PTOA have been demonstrated.

In vitro studies have reported that cell death and concomitant extracellular matrix damage are initiated at stress magnitudes of 15 to 25 MPa.[19] A stress magnitude of >40 MPa has caused complete cell death under the impacted region. One key *in vitro* study determined the effects of stress magnitude on cartilage extracellular matrix damage and cell viability in the rabbit knee. Femoral condyles were impacted with stress magnitudes of 15-50MPa at a stress rate of 420MPa/s. The stress rate was based on predictions of joint impact that may occur in contact sports, joint injuries, and ACL tears. All specimens impacted with peak stresses >35MPa showed visible surface damage in the impacted region. Superficial matrix damage was observed in 2 of 4 specimens impacted with peak stresses between 30 to 35MPa. Below 30MPa there was no visible matrix damage. A limitation of *in vitro* models is that it is not possible to investigate the cartilage mechanobiologic response to injury over time.[20]

Using a novel *in vivo* animal test system that is capable of independently applying quantifiable, precise stress magnitudes and rates to the femoral condyle of the rabbit knee, PTOA has been induced as a result of a single impact trauma to the articular cartilage and subchondral bone.[20] The extent of cell death depends on the magnitude of the impact at the time of injury. Initial cartilage injuries progress to almost complete cartilage matrix and chondrocyte loss throughout the depth of the impacted region by 3 weeks after impact. The post impact morphological biochemical observations are similar to early-to-late stage pathologic observations typically seen in human PTOA. In an important series of *in vivo* studies, the femoral condyle was impacted with a peak stress of 35MPa at a stress rate of 420MPa/s. Zero-time rabbits had histologic evidence of matrix damage patterns consisting of surface roughening and distinct cracks that propagated to 20% of the depth. Histologic sections of rabbits sacrificed

at 3 weeks after impact revealed substantial surface damage with almost complete cell loss and reduced Safranin-O staining throughout the depth of the articular cartilage that was confined to the impacted site. Threshold stress at which articular cartilage damage occurs as 25MPa at a stress rate of 420MPa/sec, corresponding to *in vivo* joint impact stress and rate commonly seen in traumatic joint injuries and sports. Cartilage responses to various loads have been reported:[21]

Table 1.

Load	Response
10MPa	No Chondrocyte Death
20MPa	No Chondrocyte Death
35MPa	50% Chondrocyte Death and Surface Fissures
50MPa	100% Chondrocyte Death and Gross Matrix Damage

ARTHRITIS FOUNDATION ACL/PTOA RESEARCH INITIATIVE

The national Arthritis Foundation is developing an ACL Intervention Initiative with the hopes of discovering disease-modifying therapies. The human ACL PTOA model will be used to study the onset and progression of OA. The specific goals of the Arthritis Foundation's ACL Intervention Initiative are:

- Determining the causes of PTOA
- Exploring biomarkers of PTOA
- Identifying individuals at risk for developing PTOA
- Developing diseases modifying pharmacological and other treatments

To achieve these goals, the Arthritis Foundation has committed $2.3M in 2012 for PTOA research ranging from the identification of biomarkers to imaging techniques. In 2013, the Arthritis Foundation has committed $1M to the ACL Intervention Initiative (Arthritis Foundation-personal communication).

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Predicting Success in ACL Reconstruction

ROBERT M. SHALVOY, MD

ABSTRACT

Anterior Cruciate Ligament (ACL) injury and ACL reconstruction is common in the United States. However, when compared to the standards of other orthopedics procedures today, ACL reconstruction is NOT predictably successful in restoring patients to their pre-injury state. Only 60–70% of reconstructed patients resume their previous level of activity and many patients experience some degree of osteoarthritis.

The reasons for such limitations of success are many. A recent renewal of interest in the many variables affecting ACL reconstruction and the understanding of the varying needs of patients with ACL injury holds promise for improving success even today as well as ultimately providing a normal knee for patients after ACL reconstruction.

KEYWORDS: anterior cruciate ligament reconstruction, knee kinematics, computer-assisted surgery

INTRODUCTION

ACL reconstruction is performed on 150,000 to 200,000 patients in the US yearly, a number that has been steadily growing for the past 25 years.[1] Despite this popularity, the long-term outcome has been surprisingly disappointing with regards to restoring the anatomy, returning patients to their previous level of activity and maintaining a healthy joint, free from the symptoms of osteoarthritis.[2] This is in part the result of a perception that ACL reconstruction is a routine surgical procedure for the general orthopedic community and supported by the fact that the majority of these reconstructions are performed by orthopedic surgeons performing less than 10 such procedures in a year. Additionally, after surgery the parameters of healing and rehabilitation needed to successfully return patients to pre-injury levels of function and performance remain poorly defined.[3]

The problem lies in approaching ACL reconstruction as a routine, generic or "one size fits all" procedure. In this paradigm, graft failures have been reported as high as 25% in athletes under the age of 25, even in the best of hands.[4] Likewise, the ability to return to previous levels of function among the most dedicated and elite athletes has been a disappointing 60%.[8] The solution is likely to lie in a better understanding of the injury and an individualization of the surgery to meet each patient's needs. With the appropriate focus on the subtleties and variations of the ACL-injured knee, ACL reconstruction, rehabilitation and functional assessment, we can move towards recreating normalcy in the knee while at the same time indentify the limitations or short-comings of each reconstructed knee and reasonably predict success in terms of function and joint health. As we move in this direction, it is important that patients have a realistic expectation of ACL reconstruction and receive the appropriate counseling for making their best decision.

Knee Function and ACL Injury

The knee is one of the more complex joints in the body requiring great mobility and stability to function properly. This is accomplished in part by the various ligaments, both intra-articular and extrarticular. The ACL predominately controls against excessive anterior movement or translation of the tibia along with internal rotation of the tibia with respect to the femur and the rest of the body above it. The ACL is a major stabilizer of the knee in pivoting activities and in positions of knee flexion ranging from 15–30 degrees.[5] This range comprises the majority of athletic functions as well as many activities of work and daily living. Given the ACL's limited blood supply and the effects of the synovial fluid environment that surrounds it, torn ACLs have no ability to heal after injury leading to altered mechanical function in the knee. It is important to note that the knee joint has a variable if not unique balance of mobility that suits one's own neuromuscular system of control resulting in a likewise unique functional starting point. The ACL injury alters knee function at this balance point creating a new "pathologic" balance point. The effect on function can vary from minimal effect to greatly disabling. To further complicate this picture, the ACL is rarely injured in a vacuum, meaning that even without frank tearing of other ligaments or the menisci, the surrounding soft tissue structures can be strained or stretched in a variety of patterns corresponding to the forces of injury that further alter the stability in both subtle and overt ways that leads to what is arguably a unique instability from ACL injury.

Recent work using computer navigation technology to measure knee kinematics during ACL reconstruction has confirmed variable patterns and magnitudes of instability resulting from what has been considered an "isolated ACL tear."[6] Clearly, a mindset of treating a variable pattern of

injury with a fixed solution paradigm is likely to successfully address only some patterns of injury while allowing others to fall through the cracks due to this variability and result in a limited correction or incompletely addressed pathology. This incomplete correction can itself result in poor function of the knee as well as allow abnormal stresses on the joint contributing to the eventual failure of the components that were corrected such as the ACL. (**Figures 1 and 2**)

Figure 1. Left knee with optical trackers applied for computer-assisted ACL reconstruction

Acute Care

From the patient's perspective, an ACL tear is a situation of acute pain, swelling and stiffness. The concept of instability is not always perceived or understood at the time of injury as the core of the problem. Knowing that surgery is typically prescribed and wanting to return to sports as quickly as possible, most athletes, young and not so young, proceed with surgical reconstruction before the acute phase resolves. When that happens, the patient goes without pre-surgical rehabilitation that can define for the patient his or her true impairment as well as allow time to address the neuromuscular and psychological components of the injury that can impact the ultimate outcome of surgery. Our own work has shown that these psychological elements have as much impact ultimately on function – positively or negatively – as knee kinematics.[7] Therefore, it is important that this is addressed prior to surgery.

ACL Reconstruction

Only once the exact pattern of instability has been identified and the distinct needs of the patient thoroughly addressed can ACL reconstruction be successfully performed with confidence. With this knowledge, the variables can be customized to address the needs of the patient. These variables include the timing of surgery (including the decision for

Figure 2. Computer graphics obtained during computer-assisted ACL reconstruction. Image documents precise tunnel placement in reference to intra-articular landmarks.

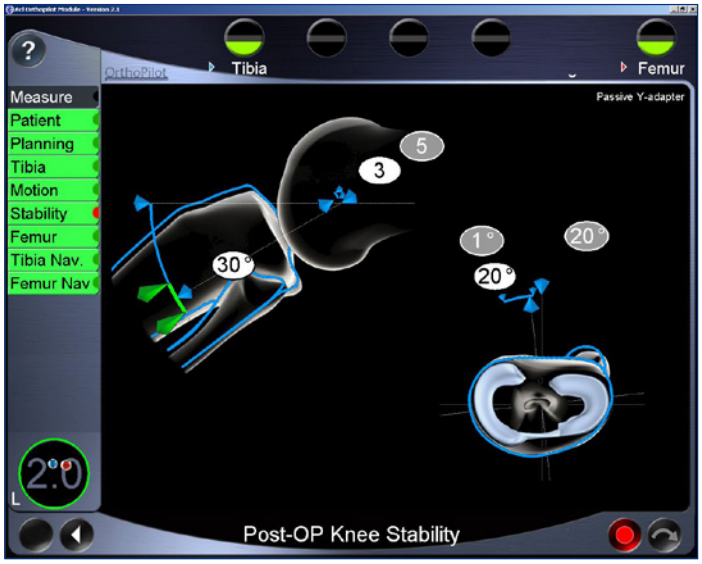

Figure 3. Knee kinematics obtained immediately after ligament fixation using computer navigation

nonoperative treatment), the type of graft material used, the number of grafts, graft fixation and additional extra-articular sugery when necessary. No single surgical technique can address all needs or situations successfully. With the use of intraoperative computer navigation, the direct effects of surgery on knee kinematics can be immediately assessed during surgery and the course of surgery modified to attain the desired outcome. Referred to as "on demand" ACL reconstruction, the result is a customized reconstruction with immediate documentation of the reestablished kinematics of the knee. **(Figure 3)** The expectation is that this will result in a better functioning knee and a greater likelihood of returning to previous functional activities.[10]

Post-op Healing and Rehabilitation

After surgery, a healing process is required for the grafted tendon material to remodel into a viable, dynamic ligament. While the acute phase requires 12 weeks, healing, complete or otherwise, is not guaranteed. Furthermore, no known graft tissue has the unique structure and mechanical function of the native ACL.[9] The goal of surgery therefore is to anatomically restore the ligament tissue in the best possible way and through remodeling attain the best functional equivalent. While the nuances of surgery as previously described can greatly affect this, establishing a nurturing intra-articular environment post operatively is equally important. Physical therapy is an important adjuvant that can help create such an environment.

Physical therapy is used to restore range of motion, reduce swelling and restore neuromuscular function. When done appropriately, this stimulates articular cartilage, helps normalize the synovial fluid environment and provides a positive stimulus for the healing ACL graft. Under stimulating or over stimulating the knee is thought to adversely affect graft healing and therefore knee function.[9] ACL rehabilitation is a subspecialty of physical therapy requiring close supervision and on-going feedback between patient, therapist and surgeon.

Function

While biological healing largely occurs during the first 12 weeks following surgery, no good determination of restored function exists.[12-14] While validated research instruments exist, these have been patient-reported outcomes and not true functional assessments. Single-leg hop and triple-hop testing through physical therapy have provided simple estimates of function but the need for better tools and methods of assessment is reflected in the alarmingly high incidence of reinjury in select groups of athletes returning to sport 6 or 7 months after surgery.[4] Similarly, the high incidence of injury to the contralateral ACL upon returning to sports implies an incomplete restoration of function in the recovering ACL patient.[11]

CONCLUSION

ACL injuries are common. They frequently have a devastating impact on knee function and can ultimately lead to joint degeneration. The traditional assumption has been that surgically restoring ligament anatomy will result in restored joint kinematics and thus joint function. Short- and long-term outcomes' research has failed to identify the limitations of current practice. As Lord Kelvin stated over a century ago, "if it cannot be measured, it cannot be improved." Currently available technologies, such as computer navigation, can be part of an increased effort to better assess and therefore better correct the pathology of ACL injury and ultimately measure the effect of surgical reconstruction on functional outcome. Patient selection, detailed, individualized surgical planning, in-depth patient education, precise intra-operative joint assessment and ligament reconstruction are all necessary now and are more likely to predict success in ACL reconstruction.

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Femoroacetabular Impingement: A Review of Current Concepts

ROHIT B. SANGAL, BA, MD'15; GREGORY R. WARYASZ, MD; JONATHAN R. SCHILLER, MD

ABSTRACT

Femoroacetabular impingement is becoming an increasingly more common diagnosis in the orthopaedic community for hip pain in the younger population. Variations in the femoral head and acetabulum can lead to a sequelae of changes to the cartilage that can lead to osteoarthritis. Diagnosis is made through a combination of patient history, physical examination, and diagnostic imaging. Plain radiographs are a very useful tool for evaluating the bony anatomy, while CT scan and MRI have roles for surgical planning and more definitive diagnosis. Most patients should trial physical therapy prior to consideration for any arthroscopic or open procedures. Long-term outcome studies are being performed to determine if surgical intervention has any impact on quality of life and development of osteoarthritis.

KEYWORDS: CAM, Pincer, hip arthroscopy, labrum

INTRODUCTION

As the population ages, primary care providers are increasingly encountering patients with hip pain. However, the differential ranges widely from muscle strains, various arthritides, vascular compromise to urological or gynecological disorders. Osteoarthritis in particular was thought to be a disease of the elderly but in past decade femoroacetabular impingement (FAI) has become increasing recognized in the younger population as a possible predisposing factor for osteoarthritis.[1] FAI describes a condition of hip pain due to an abnormal femoral head (ball) and/or acetabulum (socket). This association was first described by Ganz et al., in 2003 via inspection of hundreds of surgical hips and analysis of hip motion.[2] While understanding a cause of hip pain and increasing the diagnosis of FAI, as of 2006 it was reported that patients with hip pain went undiagnosed for on average 21 months and saw on average 3.3 providers.[3]

CAM AND PINCER LESIONS

The etiologies of FAI include CAM lesions, pincer lesions and mixed type lesions (**Figure 1).** CAM lesions are bony protrusions on the femoral head-neck junction resulting in impingement with range of motion. Consequently, during hip flexion, this defect causes shearing of the cartilage and labrum and also results in severely reduced internal rotation for the patient. The CAM lesion leads to a repetitive trauma to the anterolateral edge of the acetabulum leading to delamination of the cartilage and failure of the acetabular labrum.[4] Combination of CAM and pincer lesions can also occur which actually is the most common presentation.[4]

Figure 1. Plain Radiographs of a Combined CAM and Pincer Lesion – AP, Frog-lateral, and False Profile views of a skeletally mature individual showing a CAM lesion at the femoral head/neck junction (blue arrow) as well as an acetabular Pincer lesion (red arrow).

The etiology of FAI is generally unknown but one widely recognized cause of CAM lesions is slipped capital femoral epiphysis (SCFE).[4,5] Byrd has written that the "pistol grip" deformity may be due to premature eccentric closure of the capital physic in adolescence leading to the femoral head being a nonspherical shape, in particular with more physical activity a partial physeal arrest can occur.[4] Other proposed relationships include genetic predisposition, occupation or childhood athletics.[1,6,7] For example, studies have quantified the prevalence of CAM lesions ranging between 50-68% in adolescents and young adults 12 to 26 years old who played high level soccer or football and have further shown a 2 or 3 to 1 male to female ratio in CAM lesions.[8-12]

Interestingly, CAM lesions have been documented in asymptomatic adults. One study in 2011 by Jung et al., examined 755 hip radiographs and found asymptomatic CAM lesions in 5.5% and 14% of women and men, respectively.[13] Another study determined a 14% prevalence within their cohort.[14] Thus, CAM lesions could be incidental findings on imaging which do not necessarily require further work-up in asymptomatic patients.

While CAM lesions are defects of the femoral head, pincer lesions are defects of the acetabulum. Pincer lesions are due to either retroversion of the acetabulum or a bony overgrowth causing the anterolateral rim to cause trauma to the labrum during hip flexion.[1,4,6] The prevalence of pincer lesions in general is less than CAM lesions with studies showing in young adults 18–30 year olds 10 to 26% in soccer players[9] and as high as 66% in football players.[11]

Unlike the association of CAM lesions with males, pincer lesions have an equal male to female distribution.[15] The third etiological classification of FAI is when patients have both CAM and pincer lesions which is termed mixed type. The prevalence is of mixed type approximately 50%,[9] but probably higher.

Figure 2. C-Sign – Patients when describing the discomfort in the hip will often cup the hand and place the palm over the greater trochanter with fingers angled towards the groin.

HISTORY AND PHYSICAL EXAMINATION FINDINGS

Patient with hip pain due to FAI have several features of the history that are classic. FAI is due to chronic microtrauma to the cartilage and labrum and thus patients complain of chronic pain that is gradually worsening. Athletic patients may even recall a distant traumatic event or describe themselves as less flexible compared to teammates.[4] Often patients complain of deep medial groin pain radiating to the anterolateral region of the thigh which is termed the "C-sign" (**Figure 2**).[4,7,16] This is formed by cupping the hand and placing palm over the greater trochanter with fingers angled towards the groin.

The "restaurant sign" is when patients describe inability to sit for prolonged periods and must shift their weight or walk around to alleviate the symptoms. As predicted, these symptoms often manifest themselves worst at restaurants. Patients also describe clicks or locking with sharp stabbing pains that are worsened with pivoting, or turning towards the affected side.[4,16]

Physical exam can further confirm your suspicion of FAI. While there is a wide variety in how providers examine hips, certain exam maneuvers are classic for FAI. It is important to be cognizant that physical exam of athletes may not produce enough force on the hip to reproduce symptoms and the hip exam can be uncomfortable thus examining both hips is essential.[4,16] The most sensitive test for FAI is flexion, adduction, internal rotation (FADIR) also known as a positive impingement sign.[16] Understanding the pathophysiology explains this exam maneuver given that flexion causes a CAM or pincer lesion to come into conflict with the labrum or chondro-labral junction which results in limited internal rotation of the hip. Patients may have limited internal rotation in the setting of a CAM lesion without any labrum injury.[8]

Maximal flexion of the hip is generally uncomfortable. A Stinchfield test or resisted hip flexion may be positive. The log roll test is the most specific test for hip joint pathology because it minimizes stress on surrounding structures, but is the least sensitive.[4] It is important to note that secondary lesions such as trochanteric bursitis or muscle spasms may be more obvious to the examiner and thus FAI must be carefully evaluated.[4] Athletic pubalgia (AP) is another condition that can present similarly to FAI.[4,17] While AP and FAI are often seen in athletes, FAI and AP symptoms are reproducible with passive and resisted exam maneuvers, respectively.[4,17] Specifically, AP symptoms are seen with resisted hip flexion or adduction. When history and physical exam are suggestive of FAI, imaging studies can confirm the diagnosis.

IMAGING

Initial studies should include plain film radiographs of the pelvis in standing anteroposterior view, frog lateral of both sides and some also prefer a Dunn or modified Dunn view.[1,4,18] This allows comparison of both sides and placed

Figure 3. Alpha (α) Angle – Plain frog leg lateral x-ray measurement to evaluate the CAM lesion. The normal α angle is between 55 to 60 degrees or less. The x-ray α angle measurement is 77.2^0. The angle is measured by drawing a best-fit circle around the femoral head and then by drawing a line that runs through the center of the neck and head. A second line is then drawn to a point where the superior surface of the head-neck junction first is no longer in the circle.

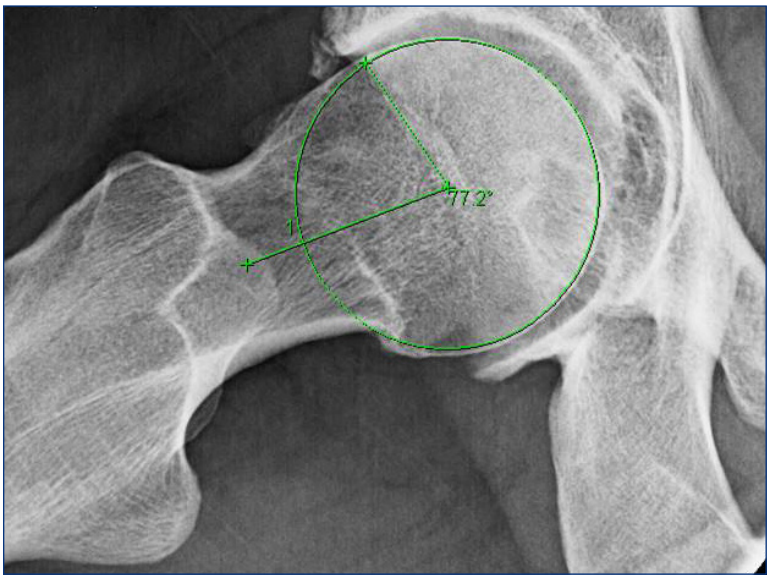


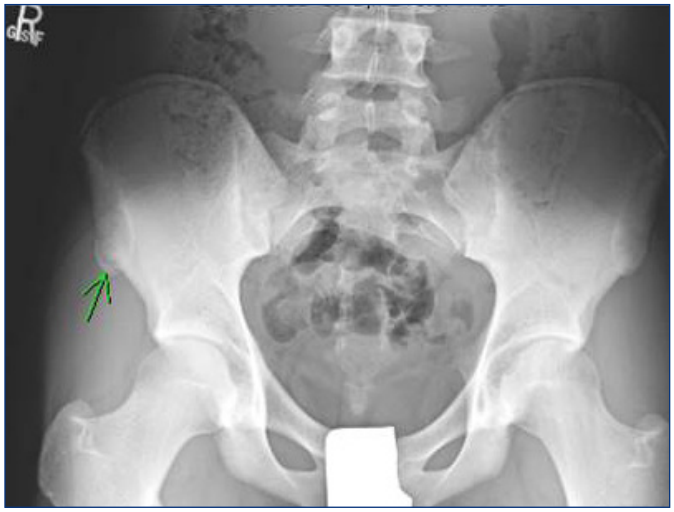
Figure 4. Crossover Sign – The Crossover Sign evaluates for acetabular retroversion. If a line drawn along the anterior wall of the acetabulum (black line) crosses the line of the posterior wall (white line), this indicates a positive crossover sign. Acetabular retroversion is very often associated with a deficient posterior wall of the acetabulum.

in the context of clinical exam. Modified Dunn view is recommended which is imaging of hip flexed 45° and abducted 20° which is sensitive for femoral head lesions[16] compared to the classic Dunn view where the hip is flexed to 90° and abducted to 20°. It is important to mention that physicians often miss radiographic findings of FAI unless they have increased suspicion of such a diagnosis.[1] These specific morphological findings include tilt deformity (CAM lesion), acetabular overcoverage (pincer lesion), crossover sign (acetabular retroversion), bone spurs or joint space narrowing (osteoarthritis).[1,4]

The common series of plain x-rays ordered for adequate work-up for FAI is the AP and a lateral view.[19] The AP view is better for identifying pincer lesions, while the lateral view is better at visualizing a CAM deformity. Lateral views ordered can be a cross-table, frog-leg, or Dunn view at 90 deg. and 45 deg. Flexion.[19] Caviagnac et al., 2012, showed that the frog-leg 45/45/30 view had the highest alpha angle measured and was valuable for diagnosing CAM lesions.[19] Konan et al. compared the alpha angles on CT and XR and found higher alpha angles on CT scan.[20] We prefer a false profile view in our series to evaluate for acetabular dysplasia by measuring a center-edge angle as well as to visualize the CAM lesion.

The alpha (α) angle is used to determine if a CAM lesion is present (**Figure 3**). Typically an α angle of 55 to 60 degrees or less normal. The α angle is measured by drawing a best fit circle around the femoral head and then a line that runs through the center of the neck and head. A second line is then drawn to a point where the superior surface of the head-neck junction first is no longer in the circle.[8]

Figure 5. Anterior Superior Iliac Spine (ASIS) Avulsion Fracture – AP radiograph of a skeletally immature individual with an ASIS avulsion fracture as indicated by the arrow.



The "pistol grip" deformity seen in CAM lesions can be well visualized on an AP radiograph.[4] The Crossover sign refers to over-coverage of the anterior acetabulum due to acetabular retroversion (**Figure 4**).[4] Global over-coverage can lead to multiple areas of impingement due to acetabular profunda or protrusion and is seen with an increased center-edge angle on many views.[4]

The presence of an os acetabula or an unfused apophysis from the rectus femoris origin can be seen on an AP x-ray. Fractures of the anterior superior iliac spine (ASIS) (**Figure 5**)

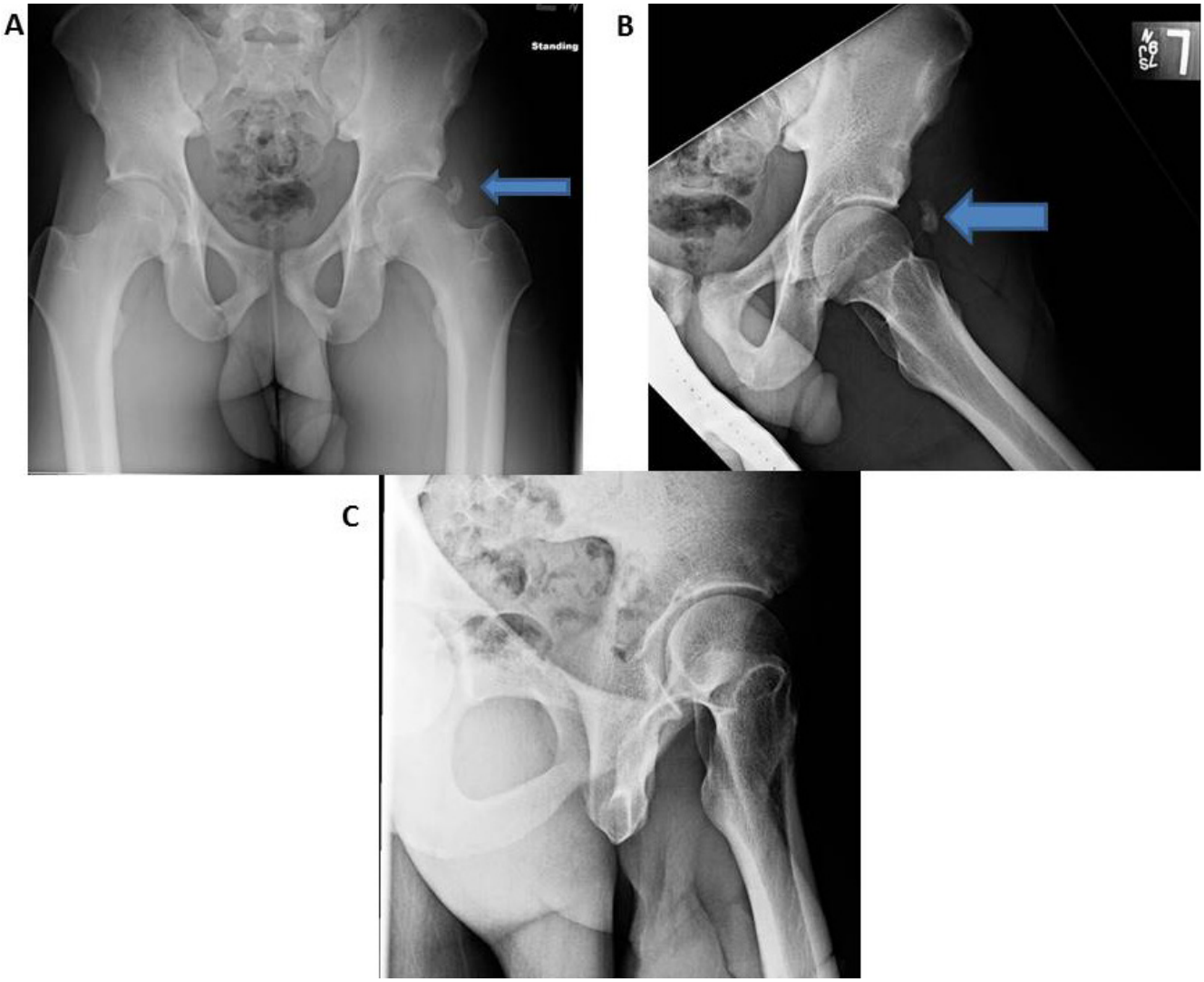
and fractures of the anterior inferior iliac spine (AIIS) (**Figure 6**) can be seen on x-ray as well. AIIS avulsion fractures can lead to impingement as well if the bony fragment becomes incarcerated. A CT scan may be helpful for determining the location of the bone and is the best for showing overall bony architecture and structure.[4] CT scans and CT scans with 3D reconstruction can also be helpful for further evaluating the size of the CAM lesion.

MRI arthrogram is best suited for evaluating labrum or cartilage pathology as it is more than 90% sensitive.[16] The arthrogram component is essential with the current magnet properties of most MRI machines. Lower resolution images from open MRI scanners and smaller magnets do not have great visualization of most lesions in the hip.[4] The magnet for the study should be at a minimum a 1.5-T magnet with surface coils.[4] We prefer a 3-T magnet and we typically do not require any contrast for the study. We recommend discussing the patient with the radiologist prior to ordering the MRI study. During the MRI arthrogram, the local anesthetic injection also helps to confirm if intra-articular pathology is the cause of the joint pain because patients typically have less pain after the injection.[4]

NON-OPERATIVE

While FAI is a result of anatomical deformities of the hip joint, non-operative treatment can offer relief to the patient. Analgesics, physical therapy, activity modification and intra-articular glucocorticoid injections are the mainstay of conservative treatment. Physical therapy focuses on strengthening core muscles and avoidance of motions that cause excessive hip flexion such as squatting or low chairs.[1,4,7] Importantly, there is no data to support one physical therapy intervention over another in terms of symptom improvement or altering the natural course of this disease.[7] Intra-articular injections are both diagnostic and therapeutic

Figure 6. Anterior Inferior Iliac Spine (AIIS) Avulsion Fracture – Radiographs of an adolescent individual with an AIIS avulsion fracture as indicated by the arrow. A is the AP view, B is the frog-leg lateral view, and C is the false profile view.



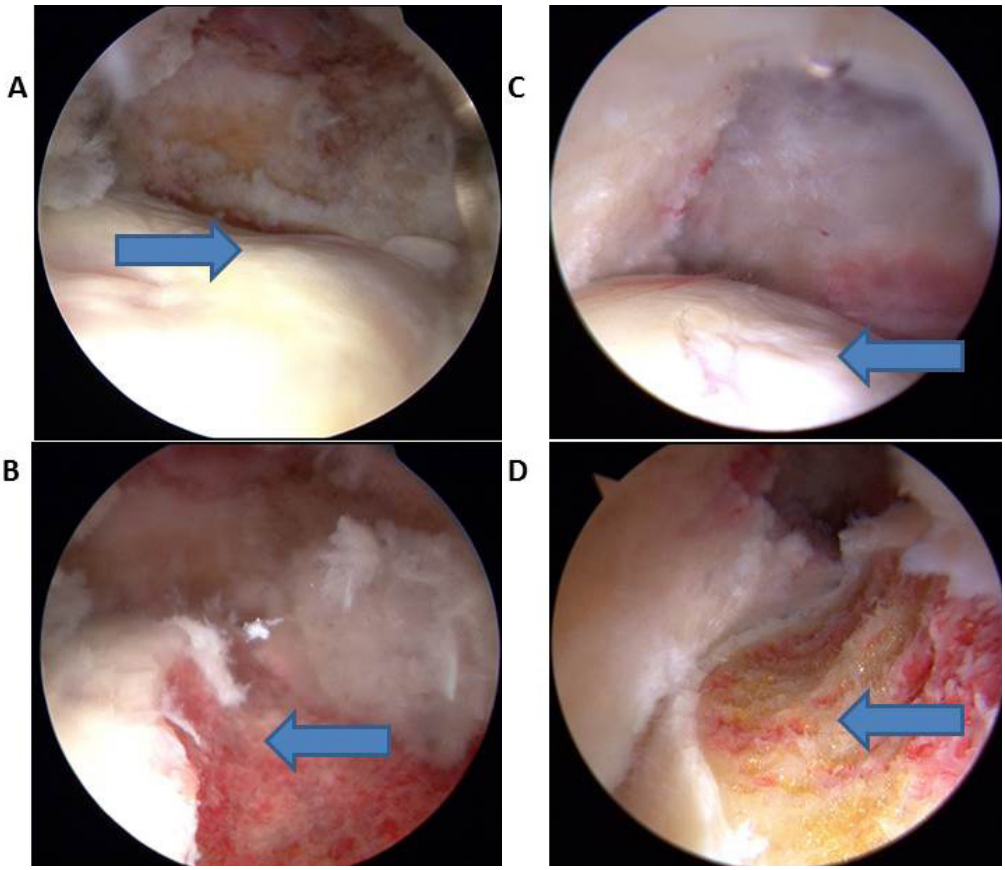


Figure 7. Pre- and Post-Arthroscopic Images of CAM Lesion Debridement at the Femoral Head/Neck Junction (Osteochondroplasty) – Images A & B show pre- and post-CAM debridement in Patient #1. Images C & D show pre- and post-CAM debridement in Patient #2. The arrows point to the area of the CAM lesion both pre- and post-CAM debridement. The comparison between patients shows how the CAM lesion can vary in size between patients.

in that if the injection relieves the pain, then it suggests the pathology is within the hip joint which can be done with an office-based ultrasound machine or at a radiology suite.[1,4,16] Referral to an orthopaedic surgeon is recommended if pain is unresolved with these conservative measures.[16]

SURGICAL TREATMENT

There are a variety of surgical interventions used to treat FAI ranging from the least invasive arthroscopy to the most invasive open surgical dislocation. Regardless of the technique, the goals of operative management are to alleviate pain, improve hip function and mobility and preserve the integrity of the hip joint.[7,16] Arthroscopy is a minimally invasive technique to examine the hip joint and evaluate the extent of injury. It can be used to debride and repair the labrum, chondral surfaces, address the bony deformity in Perthes disease or slipped capital femoral epiphysis (SCFE), and various arthritides (**Figure 7**).[21] The risks include neurovascular injury, specifically pudendal or perineal nerve palsies from traction and lateral femoral cutaneous or sciatic nerve from portal insertion, deep vein thrombosis and rarely femoral neck fracture or avascular necrosis of the femoral head.[16,22,23] However, favorable results have been reported with this method.[7,21,22,24-27] One study performed in 2011 by Byrd et al., prospectively followed their patients and reported on the results of the first 100 consecutive patients to achieve two-year follow-up. They reported 79% of their patients had good or excellent results and all nerve palsies were transient and resolved without further complication.[22] Arthritis was found to be a negative predictor of favorable outcomes which suggests early treatment of FAI is prudent to promote favorable recovery.[1,4,22,24]

FAI can also be treated with an open surgical dissection which has the benefit of full visualization or the joint is often used to fix torn labrum, resect the acetabular rim (pincer lesion) or reshape the femoral head-neck (osteochondroplasty).[7,23] However, this technique employs hip dislocation which risks injury to the femoral head blood supply and the potential for avascular necrosis of the femoral head. Some surgeons utilize a "mini-open" procedure where intra-articular pathology is treated arthroscopically and CAM lesions are resected via small anterior exposure. This method has shown to be effective at improving FAI and return to activity.[4,28] As expected, the side effects of this method are a combination of those previously mentioned of arthroscopic and open surgical technique. Overall, all of these procedures are effective at treating FAI but faster recovery and better improvement in symptoms have been reported in arthroscopic procedures while the highest complication rate has been reported in mini-open.[4,7,24,25] Arthroscopic decompression can result in improved radiographic α-angle and improved internal rotation.[29]

CONCLUSION

When encountering a patient complaining of hip pain, a thorough history and physical is essential to raise suspicion of FAI. Referral to an orthopaedic surgeon is warranted if

conservative treatments do not alleviate pain. While counseling patients about long-term outcomes can vary based on the underlying hip pathology a general follow-up is three months physical therapy with graduated three-month return to full activity as tolerated.[4] The average time to return to sports ranged from three to nine months.[4] FAI is a relatively new diagnosis that is undergoing rapid changes in terms of diagnosis, treatment and outcomes. With a keen clinical eye, early intervention can best improve outcomes in these patients.

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Disclosures

Dr. Schiller is a consultant for Depuy-Mitek.

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Sexual Risk Behaviors of Sexual Minority Students in Rhode Island, 2007–2013

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The Centers for Disease Control and Prevention (CDC)'s pooled Youth Risk Behavior Survey (YRBS) data show that nationally, 1.3% of high school students identified themselves as gay or lesbian, 2.5% reported having intercourse with same sex only, and 3.3% reported having sex with both sexes.[1,2] Sexual minority students are adolescents who identify themselves as gay or lesbian, bisexual, or unsure of their sexual identity or students who have had sexual contact with same sex only or with both sexes.[1] This study found that sexual health disparities exist in sexual minority students. In particular, the study found that sexual minority students were more likely to report having had intercourse, to have had intercourse before 13 years of age, and to have had intercourse with four or more people compared to heterosexual students. Gay or lesbian students were less likely to have used a condom at the last intercourse than heterosexual students.[1,2]

Earlier age of first intercourse, number of sexual partners, and lack of condom use are associated with increased risk of getting cancer-related pathogens, for instance, human papilloma virus (HPV).[3] Risk sexual behaviors are also related to teenage pregnancy and sexually transmitted infections (STIs) among sexual minority students.

In order to address the needs of sexual minority students and implement intervention programs effectively, Rhode Island needs statewide data on the sexual behaviors of this population. The objectives of this study were to focus on variability among sexual minorities, examine differences between sexual identity and sexual behavior, as well as examine differences between sex of sexual contacts and sexual behaviors using the Rhode Island-pooled YRBS data.

METHODS

Data source: The YRBS is an anonymous and voluntary survey among random samples of high school students in over 60 states and municipalities. The CDC developed the YRBS to monitor risk behaviors related to the major causes of mortality, disease, injury, and social problems among youth and adults in the United States. These weighted, self-reported data are representative of 9th to 12th grade public high school students statewide and can be used to make important inferences concerning health-risk behaviors. In order to increase the sample size, we combined the 2007, 2009, 2011, and 2013 Rhode Island high school YRBS data. The overall response rates across these four years ranged from 66% to 71%.

Measures: Demographic characteristics included sex (male or female), grade (9th–12th), and race/ethnicity (White, Black, Hispanic/Latino, and other).

Sexual minority students are determined by sexual identity and/or by sex of sexual contacts. Sexual identity was based on the state-added question, "Which of the following best describes you?" 1) heterosexual (straight); 2) gay or lesbian; 3) bisexual; and 4) not sure. Sex of sexual contacts was based on "What is your sex?" 1) female; 2) male and the stated-added question, "During your life, with whom have you had sexual contact?" 1) I have never had sexual contact; 2) females; 3) males; 4) females and males. We classified students as having had opposite-sex contact only, same-sex contact only, both-sex contact, or as never had sexual contact. For this study, sexual minority students were defined as those who identified as gay or lesbian, bisexual or unsure or who had same-sex contact or both-sex contact.

Sexual risk behaviors in this study include: ever had sexual intercourse; had sexual intercourse for the first time before age 13 years; had sexual intercourse with four or more people during their life; had sexual intercourse with one or more people during the past three months; had sexual intercourse during the past three months and had not used a condom during last sexual intercourse; and had sexual intercourse during the past three months and had not used birth control pills to prevent pregnancy before last sexual intercourse.

Statistics analyses: We calculated unweighted frequency and weighted percentages. We conducted all analyses with the Surveyfreq Procedure in SAS version 9.3 (SAS Institute, Inc, Cary, North Carolina) to account for the complex design of the YRBS.

RESULTS

Table 1 shows the number and proportions of major demographic characteristics. In the Rhode Island pooled data, 90.3% of high school students identified as heterosexual, 1.9% as gay or lesbian, 5.1% as bisexual, and 2.7% as unsure. More than half of the students (53.6%) reported having had sexual contact with the opposite sex, 2.7% reported having had sexual contact with the same sex, 4.8% reported having had sexual contacts with both sexes, and 38.9% reported having had no sexual contact.

Table 2 shows the distribution of sexual contacts by sexual identity for public high school students. Among sexually active students, more than half who engaged in same-sex

behavior identified as heterosexual (54.3%) while over a quarter identified as gay or lesbian (28.5%) and 11.9% identified as bisexual. Among those who had sexual contact with both sexes, 31.8% identified as heterosexual while 51.0% identified as bisexual, and 10.9% were not sure of their sexual identity.

Table 3 shows the distribution of sexual behavior by sexual identity for public high school students. Gay or lesbian, bisexual, or students not sure of sexual identity were more likely than heterosexual students to report having ever had intercourse, having had intercourse before 13 years of age, and having had intercourse with ≥4 people. Those students were less likely to report having used a condom or birth control pills during their last sexual intercourse compared to heterosexual students.

Table 4 shows the distribution of sexual behaviors by sex of sexual contacts for public high school students. Students having had sexual contact with both sexes were more likely to have ever had intercourse, to have had intercourse before 13 years of age, to have had intercourse with ≥4 people, and to have had intercourse with ≥1 person in the past 3 months than students having had sexual contact with the opposite sex only. Students who had sex with both sexes were also less likely to have used a condom or birth control pills at the last intercourse compared to students having opposite sex only.

DISCUSSION

Rhode Island high school students who identify as gay or lesbian or as bisexual exhibit more sexual risk behaviors than their self-identified heterosexual peers. In addition, students who have had sexual contact with both males and females are at higher risk than their peers who have had sexual contact with the opposite sex only. Moreover, those who have had sexual contact with the same sex engage in sexual risk behaviors that are generally similar as students having opposite sex only. This potentially presents a somewhat more complex picture than previous studies in which sexual minorities exhibit higher risk across the board than their heterosexual peers.[4-6] However, due to relatively small sample sizes, it is hard to determine the extent to which this pattern would hold up under further study.

Gay or lesbian students were more likely not to use birth control pills during their last sexual intercourse than heterosexual peers (**Table 3**). Students with same sex sexual contact are at the same level of risk that is surprisingly close to those with opposite sex contact only, except the percentage of not using birth control pills is highest among the three groups (**Table 4**). Females whose last intercourse was with another female may contribute to the high percentages of no birth control pill use among gay or lesbian (92.2%) or those with same sex sexual contact only (88.6%).

Because of social stigma or peer pressure or as part of their identity exploration process, some self-reported lesbians may have sex with males, and some self-reported gays may have sex with females.[4,7] This occasional experimentation will result in the higher rate of teenage pregnancies than their heterosexual peers.[2,8] The sexual risk behaviors revealed by sexual minority students often reflect reactions to non-acceptance by peers.[9] If sexual minority students continue to engage in the sexual risk behaviors, they will be

Table 1. Demographic characteristic of high school students, Rhode Island 2007–2013

Characteristic	n	Weighted %
Sex		
Male	5,544	50.2
Female	6,002	49.8
Grade		
9th grade	3,280	28.5
10th grade	3,291	25.6
11th grade	2,610	23.4
12th grade	2,264	22.5
Race/Ethnicity		
White, non-Hispanic	6,219	68.4
Black/African American	890	8.6
Hispanic/Latino	2,951	18.4
Other	1,220	4.5
Sexual identity		
Heterosexual (straight)	10,364	90.3
Gay or lesbian	229	1.9
Bisexual	631	5.1
Not sure	322	2.7
Sex of sexual contacts		
Opposite sex only	5,992	53.6
Same sex only	343	2.7
Both sexes	568	4.8
Never had sexual contact	4,643	38.9

Table 2. Sex of sexual contacts by sexual identity among high school students, Rhode Island 2007–2013

Sex of sexual contacts	Weighted % (95% Confidence Interval)			
	Heterosexual (straight)	Gay or lesbian	Bisexual	Not sure
Opposite sex only	95.8 (95.1-96.4)	0.5 (0.3-0.7)	2.4 (1.9-2.9)	1.4 (1.0-1.8)
Same sex only	54.3 (47.7-60.9)	28.5 (22.9-34.0)	11.9 (8.0-15.8)	5.4 (2.9-7.9)
Both sexes	31.8 (27.2-36.3)	6.3 (4.3-8.4)	51.0 (45.9-56.2)	10.9 (7.2-14.6)
Never had sexual contact	92.6 (91.8-93.4)	1.4 (1.0-1.8)	2.7 (2.1-3.3)	3.3 (2.8-3.8)

Table 3. Percentage of sexual behavior by sexual identity among high school students, Rhode Island 2007–2013

Sexual behavior	n (weighted %)	Weighted % (95% Confidence Interval)			
		Heterosexual (straight)	Gay or lesbian	Bisexual	Not sure
Had sex ever	4,310 (42.4)	41.0 (38.8-43.2)	62.7 (54.7-70.6)	65.1 (59.8-70.4)	40.4 (33.8-46.9)
Had sex before 13	574 (5.0)	4.3 (3.6-5.1)	19.2 (11.5-26.8)	10.2 (7.7-12.8)	11.5 (7.7-15.3)
Had sex with ≥4 people in life	1,050 (10.1)	9.2 (8.0-10.3)	20.4 (12.6-28.3)	23.0 (19.0-27.0)	13.2 (9.0-17.5)
Had sex with ≥1 people 3 months	3,072 (30.7)	29.5 (27.7-31.3)	50.9 (43.6-58.2)	48.3 (42.8-53.9)	28.5 (22.6-34.3)
Not used condom during last sex	1,133 (36.4)	34.7 (32.3-37.1)	65.6 (51.4-79.8)	44.2 (38.3-50.1)	48.2 (33.7-62.6)
Not used birth control pills last sex	2,347 (76.7)	76.1 (73.4-78.7)	92.2 (82.6-101.9)	78.1 (72.4-83.8)	82.1 (71.2-93.0)

Table 4. Percentage of sexual behavior by sex of sexual contact among high school students, Rhode Island 2007–2013

Sexual behavior	n (weighted %)	Weighted % (95% Confidence Interval)		
		Opposite sex only	Same sex only	Both sexes
Had sex ever	4,283(69.7)	69.1 (66.4-71.9)	69.0 (63.3-74.8)	76.7 (72.8-80.6)
Had sex before 13	564(8.1)	7.5 (6.2-8.8)	10.8 (6.6-15.0)	14.0 (11.0-17.0)
Had sex with ≥4 people in life	1,039(16.5)	15.4 (13.6-17.2)	12.2 (7.9-16.5)	32.0 (26.8-37.2)
Had sex with ≥1 people 3 months	3,054(50.4)	49.8 (47.4-52.2)	48.6 (40.8-56.3)	58.0 (52.3-63.6)
Not used condom during last sex	1,122(36.2)	34.2 (32.0-36.4)	46.8 (35.2-58.3)	52.3 (46.1-58.5)
Not used birth control pills last sex	2,334(76.7)	75.9 (73.2-78.6)	88.6 (79.9-97.2)	80.3 (74.5-86.2)

more likely to contract sexually transmitted infections and to have cancers during adulthood.[3]

Sexual minority students are at high risk of being bullied by peers, and this victimization elevates the risk for depression and attempted suicide.[2,9] Creating safe school environments is important to help prevent this. For instance, schools may form Gay-Straight Alliances (GSAs) and/or adopt policies, procedures and programs that support safe school environments.[1,6,9,10] Teachers should set positive norms of student attitudes and behaviors to protect sexual minority students.[10] With proper support and guidance, most sexual minority students will become adults without significant elevated sexual risk behaviors compared with their peers.[2]

Physicians or nurses can play an important role when care is confidential and the office staff is welcoming and nonjudgmental to sexual minority youth. Pediatricians or primary care providers should realize that the internalized stigma of being a sexual minority teenager often results in distress and depression and increases risk behaviors, and acknowledge that being a sexual minority adolescent is not a risk behavior.[11] They can use gender-neutral terms to encourage sexual minority adolescents to discuss their sexual orientation or sexual behaviors. Physicians have an obligation to discuss sexual behaviors with respect to HIV/AIDS, STIs, and teen pregnancy; promote condom use for all sexual activities; and reinforce abstinence as a preferred method of STIs prevention and unwanted pregnancies, regardless of sexual orientation.[2]

There are three limitations of this study. First, if the same school was examined in the 2007, 2009, 2011 and 2013, some duplication of participants was possible. Second, the YRBS-pooled data are cross-sectional and only can draw associations between sexual identity and sexual behaviors, or sex of sexual contact and sexual behaviors. Third, due to sample size, we cannot prove sexual risk behaviors among sexual minority students are the same across racial/ethnic groups or between both sexes.

Although there are limitations, there are some strengths as well. First, YRBS is the only population-based surveillance data in Rhode Island that monitors the prevalence of sexual risk behaviors among sexual minority students defined by sexual identity and sex of sexual contacts. Second, sexual minority students represent a relatively small proportion of all students. In order to make policy and intervention decisions, use of large population-based samples is important for obtaining the most generalizable and highest quality data. Third, we analyzed sexual risk behavior data by sexual identity and sex of sexual contacts. This enabled us to make finer distinctions of numerous groups including students who reported being not sure of their sexual identity.

In summary, there is some discrepancy between how students identify themselves sexually and their self-reported behavior in terms of the sex of sexual contacts (**Table 2**). Students who identify as gay/lesbian have higher sexual risk than their heterosexual peers and similar to (if not even higher than) their bisexual peers (**Table 3**). Based on the findings from **Table 3**, one would expect elevated risks of students who reported same sex only sexual contacts, yet those whose prior behavior appears gay/lesbian have risk levels that are similar to those with heterosexual behavior and lower than those with bisexual behavior (**Table 4**).

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VITAL STATISTICS
MICHAEL FINE, MD
DIRECTOR, RHODE ISLAND DEPARTMENT OF HEALTH
COMPILED BY COLLEEN A. FONTANA, STATE REGISTRAR

Rhode Island Monthly Vital Statistics Report
Provisional Occurrence Data from the Division of Vital Records

VITAL EVENTS	REPORTING PERIOD		
	MAY 2014	12 MONTHS ENDING WITH MAY 2014	
	Number	Number	Rates
Live Births	952	11,252	10.7*
Deaths	865	9,899	9.4*
Infant Deaths	6	69	6.1#
Neonatal Deaths	5	54	4.8#
Marriages	713	6,930	6.6*
Divorces	249	3,236	3.1*
Induced Terminations	227	3,158	280.7#
Spontaneous Fetal Deaths	37	624	55.5#
Under 20 weeks gestation	31	501	50.6#
20+ weeks gestation	6	79	7.0#

* Rates per 1,000 estimated population
# Rates per 1,000 live births

Underlying Cause of Death Category	REPORTING PERIOD			
	NOVEMBER 2013	12 MONTHS ENDING WITH NOVEMBER 2013		
	Number (a)	Number (a)	Rates (b)	YPLL (c)
Diseases of the Heart	201	2,426	230.3	3,430.0
Malignant Neoplasms	222	2,363	224.4	5,852.5
Cerebrovascular Disease	32	410	38.9	600.0
Injuries (Accident/Suicide/Homicide)	60	733	69.6	10,785.0
COPD	32	499	47.4	457.5

(a) Cause of death statistics were derived from the underlying cause of death reported by physicians on death certificates.
(b) Rates per 100,000 estimated population of 1,051,511 (www.census.gov)
(c) Years of Potential Life Lost (YPLL).

NOTE: Totals represent vital events, which occurred in Rhode Island for the reporting periods listed above.
Monthly provisional totals should be analyzed with caution because the numbers may be small and subject to seasonal variation.

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Working for You: RIMS advocacy activities

October 1, Wednesday

OHIC meeting, co-pays and deductibles

Community meeting regarding Ebola

October 2, Thursday

Opioid prescribing regulations, Drug & Alcohol Treatment Association

October 3, Friday

Health Care Leaders, RI Foundation, Drs. Karczmar, Jones, Puerini, and Kurose attending

October 6, Monday

Opioid prescribing regulations, Department of Health

October 7, Tuesday

RIMS Physician Health Committee (Herbert Rakatansky, MD, Chair)

Opioid prescribing regulations, Drug & Alcohol Treatment Association

DOH Public Hearing, Vital Records Regulations

Health Care Planning and Accountability Advisory Council (HCPAAC)

October 8, Wednesday

Meeting at Lt. Governor's office regarding SIM proposal

SIM meeting, CMS preparation

Board of Medical Licensure and Discipline (BMLD) Meeting

Community meeting regarding Ebola

October 9, Thursday

Meeting with Naturopaths

RI Academy of Physician Assistants Event; Diane Siedlecki, MD, honoree

October 10, Friday

OHIC conference call regarding SIM presentation

October 14, Tuesday

HealthSource RI Expert Advisory Committee, Drs. Elaine Jones and Elizabeth Lange attending

October 15, Wednesday

SIM presentation; RIMS members Drs. Kurose, Hittner, Puerini, Fine, and RIMS staff participating

RIMS Insurance Brokerage Board of Directors Meeting (Peter A. Hollmann, MD, President and Board Chair)

October 16, Thursday

Opioid regulations conference with HARI and RI Dental Association

October 17, Friday

COMHPRI meeting

Meeting with RI ACEP regarding Medicaid reimbursement

October 20, Monday

Meeting with HSRI Executive Director regarding re-enrollment policies

October 21, Tuesday

RI Medical Journal meeting

Opioid regulations meeting, DATA

Opioid regulations meeting, DOH

Meeting with Drs. Fine and Karczmar

OHIC Health Insurance Advisory Council

October 22, Wednesday

Meeting with Greater Providence Chamber of Commerce regarding legislation and membership

Community meeting regarding Ebola.

RIMS Membership Committee; Drs. Jones and Siedlecki, Co-chairs

October 24, Friday

Behavioral Health and Addiction Recovery Coalition Meeting,

Meeting with Laura Adams, President/CEO, RI Quality Institute, and Department of Health, Health Services Council

Conference call with AMA

October 27, Monday

Health Care Leaders Group, RI Foundation; Drs. Karczmar, Jones, Puerini, and Kurose attending

Recovery Works coalition

Council Meeting; guest Lieutenant Governor Elizabeth Roberts

October 28, Tuesday

Health Services Council

Meeting with HealthSource RI Executive Director, Drs. Karczmar, Settipane, and RIMS staff

Marcello fundraiser

On October 27, RIMS president Peter Karczmar, MD, presented the Dr. John Clarke Award to Lt. Gov. Elizabeth Roberts. This RIMS Award was established in 2014 to honor individuals who have made exceptional contributions to public life through outstanding civic leadership and service.

October 29, Wednesday

OHIC Admin Simplification meeting regarding co-pays and deductibles

Senate Commission to Study the Impact of Health Plan Patient Liability Provisions on Access to Healthcare and Provider Financial Condition

Community meeting regarding Ebola

October 30, Thursday

Meeting with Blue Cross Blue Shield of RI, Drs. Karczmar and Settipane attending

October 31, Friday

Tobacco-free RI Annual Meeting

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Health Department announces updated drug overdose numbers

PMP data show amount and volume of prescribed controlled substances is not decreasing

PROVIDENCE – The Rhode Island Department of Health (HEALTH) recently reported the latest numbers on apparent accidental drug overdose deaths, use of Narcan by Rhode Island Emergency Medical Services, and prescribed controlled substances.

Since January 1, 2014, there have been 162 apparent accidental drug overdose deaths, nine of which occurred in the month of October.

Of the total number of apparent accidental drug overdose deaths since January 1, 2014, 141 (90%) of the screened cases involved at least one opioid or medication. At least 59 (38%) of the screened cases involve fentanyl that appears to have come from an illicit source.

These apparent accidental drug overdose deaths have taken place in 30 different cities and towns in Rhode Island affecting men and women of all ages and ethnicities:

115 men and 47 women ranging in age from 20 to 65: 31 people in their twenties, 48 people in their thirties, 37 people in their forties, 40 people in their fifties, and 6 people in their sixties; 148 people were white, 13 were black, and 1 was Asian.

Since January 1, 2014, Rhode Island Emergency Medical Services (EMS) has administered 1267 doses of Narcan. From April 2–October 14, emergency departments in Rhode Island have administered Narcan 87 times.

Data from Rhode Island's Prescription Monitoring Program (PMP), which are available to the public on the Department's website, continue to demonstrate that the amount and volume of prescribed controlled substances is not decreasing. In September, 116,383 individuals filled a prescription for a schedule 2, 3, or 4 drug in Rhode Island. Likewise, in September alone, 1.16 million doses of stimulants, 1.6 million doses of schedule 2 pain medicines, and 5.4 million doses of benzodiazepines were prescribed.

"It is clear that Rhode Island continues to experience a prescription drug and street-drug overdose crisis. Despite all of the media attention and the increased focus in the medical community, overdoses and over-prescribing are still happening. This is still a major crisis and we need to continue to put forth our state's best effort to combat addiction and overdose deaths," said Michael Fine, MD, director of the Rhode Island Department of Health. ❖

Health Department awarded $3.5M to target chronic diseases

New program addresses obesity, diabetes, heart disease, and stroke

PROVIDENCE – The Rhode Island Department of Health was awarded a grant of $3.5 million to support implementation of population-wide and priority population approaches to prevent obesity, diabetes, and heart disease and stroke, and reduce health disparities in these areas among adults on a statewide basis.

The State and Local Public Health Actions to Prevent Obesity, Diabetes, and Heart Disease awards are part of a U.S. Department of Health and Human Services (HHS) initiative to support public health efforts to reduce chronic diseases, promote healthier lifestyles, reduce health disparities, and control health care spending. The Centers for Disease Control and Prevention will administer the grants, which will run for 4 years, subject to availability of funds.

Overall, HHS awarded $69.5 million in new grant awards to 21 state and large-city health departments to prevent obesity, diabetes, heart disease, and stroke and reduce health disparities among adults through combined efforts of communities and health systems. The State and Local Public Health Actions awards are financed by the Prevention and Public Health Fund of the Affordable Care Act. This new program complements and expands on a state-level program, State Public Health Actions, that began in 2013.

States will sub-award half of their funds to support activities in four to eight communities each. Community approaches will build support for lifestyle change, particularly for those at high risk, to prevent diabetes, heart disease, and stroke. Health system efforts will focus on linking community programs to clinical services for populations with the largest disparities in high blood pressure and pre-diabetes.

Specifically, the work that communities will do to have a statewide impact will be to employ strategies that promote health, support and reinforce healthful behaviors, and build support for healthy living for the general population and particularly for those with uncontrolled high blood pressure and those at high risk for developing type 2 diabetes. Priority populations include people with racial/ethnic or socioeconomic disparities, including inadequate access to care, poor quality of care, or low income.

"Achieving the best preventive health care is vital to successful health outcomes. Primary care providers supports the work of the health care system through provision of services such as mammography and tobacco cessation counseling for underserved populations, work on issues of health care access, planned care, self-management, patient navigation, and quality prevention services. Through community-based public health efforts that support intensive and sustained interventions that include health care settings, together we can improve population health outcomes," said Michael Fine, MD, Director of Health. "In this country, chronic diseases such as heart disease, cancer, and diabetes are the leading causes of death, disability, and health care costs, accounting for 7 of 10 deaths among Americans each year, and more than 80 percent of the $2.7 trillion our nation spends annually on medical care." ❖

Hydrocodone reclassified as a Schedule II Medication

PROVIDENCE – The R.I. Dept. of Health recently announced that hydrocodone, an opioid-type medication, was reclassified as a Schedule II medication effective October 6, 2014.

Hydrocodone and all its combinations collectively represented the most popular pain medication prescribed in Rhode Island. Vicodin is a common brand name that contains hydrocodone. A review of 2013 data reveals there were more than 22.6 million doses filled. Schedule II medications have stricter regulation, reflective of the increased risk these medications have.

A summary of some of the rules surrounding all schedule II medications:

- The prescription must be written and signed by the prescriber.
- The prescription cannot have refills.
- The prescription is not valid after 90 days from the date it was written.
- A verbal prescription is allowed only in emergency situations and a written prescription must follow within seven days. (The pharmacist will notify the Drug Enforcement Agency if a written prescription is not received.)
- Faxed, original prescriptions are only allowed for:
  Home infusion/IV pain therapy
  Long-term-care facilities
  Hospice/terminally-ill patient
- Prescriptions have the following quantity limitations:
  30-day supply

Practitioners may write up to three separate prescriptions (each for up to a one-month supply) and each prescription must be signed and dated on the date they were originally written. In addition, the practitioner must write the earliest date each of those subsequent prescriptions may be filled, with directions to the pharmacist to fill no earlier than the date specified on the face of the prescription.

These are not all the rules surrounding hydrocodone and its varying combinations; however, prescribers will be responsible for following all of the rules when prescribing hydrocodone.

It is likely this will have a significant impact on office practices as schedule II prescriptions cannot be phoned in to a pharmacy. HEALTH encourages e-Prescribing of Schedule II medications for safety and security. ❖

Kent launches colorectal robotic surgery service

PROVIDENCE – Care New England recently launched a new colorectal robotic surgery service at Kent Hospital.

CHARLES RARDIN, MD, director of minimally-invasive surgery (MIS) at Care New England, said, "Our program is designed to bring the benefits of MIS, which include shorter hospitalization, less pain, quicker recovery and reduction in some complication rates, to a wider group of people. The new technologies such as Firefly imaging, offer promise in the safety and efficiency of gallbladder removal, as well as in several different forms of surgery for cancer care."

Recent advances include a successful launch of a colorectal robotic surgery service at Kent, under the direction of **MELISSA MURPHY, MD,** who completed a colorectal fellowship at Brigham and Women's Hospital in Boston.

Kent is only the second hospital in New England and the first in Rhode Island to utilize a fully robotic stapling device in colorectal surgery. This technological advancement overcomes several limitations of traditional handheld stapling devices and promises fewer complications after surgery. Earlier this year, Care New England also launched a robotic cholecystectomy program for gallbladder removal at Kent.

After installing its da Vinci surgical robot last year, Kent has quickly established a ground-breaking robotics service. Surgeon **JOSEPH BRADY, MD**, became the first in Rhode Island to perform a single site gallbladder removal, allowing the entire procedure to be done through one small incision in the belly button. In addition, Dr. Brady and **BRIAN REED, MD**, became the first in Rhode Island to complete several other surgical procedures robotically, including: Nissen Fundoplication, for gastroesophageal reflux disease (GERD); inguinal hernia repair; and ventral hernia repair. ❖

OHIC awarded $1.1M rate review grant

CRANSTON – The Office of the Health Insurance Commissioner (OHIC) is one of 21 states that have been awarded a $1.1 million "Grant to States to Support Health Insurance Rate Review and Increase Transparency in the Pricing of Medical Services, Cycle IV" from the Center for Consumer Information & Insurance Oversight (CCIIO).

This funding opportunity will allow OHIC to continue to enhance and institutionalize Rhode Island's rate review program, as well as coordinate and streamline efforts to improve price transparency, and increase its ability to analyze vital information about the health care system.

Specific projects OHIC will execute are effective rate monitoring and market conduct review programs; standardization of issuer price transparency requirements; coordination of rate review with form review; increased form transparency and consumer support; and expansion of the All Payer Claims Database (APCD) analytic and reporting activities.

"Rate Review Cycle IV Grant funding will provide needed support as OHIC works to enhance the effectiveness of our rate review process, as well as increase our capacity to collect, analyze, and report relevant data," said Health Insurance Commissioner, Dr. Kathleen Hittner.

With this latest $1.1 million award, Rhode Island has been awarded a total of $8.6 million from the CCIIO Rate Review Grants. ❖

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Urologist Mark Sigman, MD, addresses FDA panel on testosterone replacement therapy

Advisory panel voted nearly unanimously to tighten regulation of multibillion-dollar testosterone industry; recommended studies to demonstrate benefit, safety of testosterone-replacement products

PROVIDENCE – **MARK SIGMAN, MD**, chief of urology at The Miriam and Rhode Island hospitals, co-director of the Men's Health Clinic at The Miriam Hospital, and chief of urology at The Warren Alpert Medical School of Brown University, spoke about hypogonadism last month at a joint meeting of the Bone, Reproductive and Urologic Drugs Advisory Committee and the Drug Safety and Risk Management Advisory Committee.

The combined United States Food and Drug Administration (FDA) advisory panel, whose advice the FDA often follows, gathered to discuss who should receive testosterone replacement therapy, as well as the potential for cardiovascular risk related to the therapy. The FDA has been exploring the risk of stroke, heart attack and death among men taking FDA-approved testosterone products in response to conflicting studies examining the cardiovascular risks in men undergoing testosterone therapy.

"The first testosterone product, which appeared in the 1950s, was prescribed for patients with 'Classic' Low T (testosterone) – hypogonadism due to known underlying medical conditions," Dr. Sigman says. "At that time, drug companies had only to show that testosterone products raised testosterone – not that they improved symptoms. Since then, in spite of the surge in testosterone replacement therapy for Low T, there haven't been any major changes to the indications for the use of testosterone products – so this is a significant industry development."

Among the advisory panel's recommendations in the almost unanimous committee vote were making changes to what has been called vague testosterone-replacement product labels to address the increasingly prevalent use of testosterone for hypogonadism related to aging – or Andropause – Low T due to decreased T production that accompanies aging. The number of testosterone prescriptions has increased approximately eight-fold since 2000. The panel also voted at the meeting to require drug makers to conduct tests or studies to assess the cardiovascular risk related to use of testosterone drugs.

Testosterone deficiency (TD) indicates a low testosterone level in the blood. Hypogonadism indicates a low testosterone level in the presence of symptoms of low testosterone. Testosterone deficiency afflicts approximately 20 to 30 percent of men ages 40-79 years old, with an increase in prevalence strongly associated with aging and common medical conditions including obesity, diabetes and hypertension.

Dr. Sigman's presentation about hypogonadism to the FDA panel focused on what male age-related hypogonadism is and how to diagnose it; the difference between age-related and classical hypogonadism; the reasons behind diagnosing and treating hypogonadism; and the risks of testosterone treatment for hypogonadism. Dr. Sigman spoke about symptoms, indications for treatment, and how all guidelines require symptoms of hypogonadism. He also discussed how Low T alone is insufficient without symptoms – and how the prevalence of Low T (by blood test alone) is greater than the prevalence of hypogonadism (Low T plus symptoms of Low T). While there are a variety of types of testosterone measurements (total testosterone, free testosterone, and bioavailable testosterone), Dr. Sigman says most studies and guidelines are based on Total T.

Dr. Sigman received his medical degree from University of Connecticut School of Medicine. He is a nationally recognized expert on male infertility and sexual dysfunction with over 25 years of experience in the diagnosis and treatment of urologic and reproductive problems. ❖

LIFESPAN

Dr. Sigman's conclusions presented to the panel

- Clinical hypogonadism is common.
- Many symptoms and co-morbidities are associated with low testosterone.
- Criteria for who to treat is controversial, as it's difficult to clearly separate those who benefit from those who don't.
- Reasonable evidence exists that treatment is beneficial for some with either classical or age-associated hypogonadism.
- Long-term safety will not be determined without large clinical trials.

Bradley Hospital study finds sleep difficulties common among toddlers with psychiatric disorders

PROVIDENCE – **JOHN BOEKAMP, PHD,** clinical director of the Pediatric Partial Hospital Program (PPHP) at Bradley Hospital recently led a study that found sleep difficulties - particularly problems with falling asleep - were very common among toddlers and preschool-aged children who were receiving clinical treatment for a wide range of psychiatric disorders. The study, titled "Sleep Onset and Night Waking Insomnias in Preschoolers with Psychiatric Disorders," is now published online in the journal *Child Psychiatry & Human Development*.

"The most common sleep difficulties reported nationally for toddlers and preschoolers are problems of going to bed, falling asleep and frequent night awakenings – collectively, these problems are referred to as behavioral insomnias of childhood," said Boekamp. "Sleep problems in young children frequently co-occur with other behavioral problems, with evidence that inadequate sleep is associated with daytime sleepiness, less optimal preschool adjustment, and problems of irritability, hyperactivity and attention."

Boekamp's team was interested in learning more about sleep and sleep problems in young children with behavior problems, as early sleep problems may be both a cause and consequence of children's difficulties with behavioral and emotional self-regulation. "Essentially, these young children might be caught in a cycle, with sleep disruption affecting their psychiatric symptoms and psychiatric symptoms affecting their sleep-wake organization," said Boekamp.

"This study is a great reminder that it's critical for mental health providers working with young children and their families to ask about children's sleep," he said. "Simple questions about children's sleep patterns, including how long it takes a child to fall asleep at night and how frequently a child awakens after falling asleep, may yield important information that is relevant to clinical care, even when sleep problems are not the primary focus of treatment." ❖

Blue Cross & Blue Shield of RI, CNE launch Maternity Care Initiative

PROVIDENCE – Blue Cross & Blue Shield of Rhode Island, Care New England, and its employed and interested community physicians recently announced the first phase of an initiative providing an integrated care model and innovative payment model for obstetrical patients.

According to **MAUREEN G. PHIPPS, MD**, chief of the department of Obstetrics and Gynecology at Women & Infants, "Providers across our community embrace and adopt best practices and protocols for obstetrics. The initiative with Blue Cross offers a unique opportunity to engage a broader range of partners in the establishment and adoption of community-wide clinical best practices."

"This program is unique in that the architects include physicians, a health care system and a health insurer," said Dennis D. Keefe, president and CEO of Care New England. "The fact that this group produced a new care delivery and payment model is strong testament to the commitment, trust and transparency of all involved."

Phase I of the program will focus on the family's experience at Women & Infants Hospital at the time of delivery and the six weeks following delivery; it will include providing an increased level of service in the transition from hospital to home, post-delivery nursing visits, more intensive focus on support of the new family unit, such as family planning and depression screening, as well as education and screening for long-term risks associated with gestational diabetes. Phase II is expected to focus on developing evidence-based care protocols to manage prenatal care.

"This initiative is the best example we have in Rhode Island to date of providers, from the hospital system and from the community, working together to improve on the already strong care model for a population of very important patients. This combined with a new payment methodology that incents an evidence-based, best practice approach to maternity care is just the beginning of larger changes in health care delivery and financing that Blue Cross and all of our provider partners are working toward," said Peter Andruszkiewicz, president and CEO for BCBSRI. "In this new model, the patient is at the center, care teams are coordinated and far more integrated and payment arrangements provide financial incentives for the health of populations."

This program grew out of a long-term strategic partnership between BCBSRI and CNE that launched in 2012. Phase I of this two-part program will launch January 1, 2015 and Phase II will be developed in 2015. ❖

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Terrie Fox Wetle, PhD

Stephen Helfand, MD

PHOTOS BROWN UNIVERSITY

American Federation for Aging Research to honor Drs. Wetle, Helfand

PROVIDENCE — **TERRIE FOX WETLE, PhD**, dean of the Brown School of Public Health, and **STEPHEN HELFAND, MD**, professor of biology, will receive awards from the American Federation for Aging Research (AFAR) on Nov. 7 at the annual scientific meeting of the Gerontological Society of America.

Dr. Wetle will receive the federation's Irving S. Wright Award of Distinction, named in honor of AFAR's founder and recognizes exceptional contributions to basic or clinical research in the field of aging. Dean Wetle studies end-of-life care, ethical issues in geriatrics, and promoting health of aging populations. In bestowing the award, AFAR recognized her for "leadership that significantly helped translate biomedical research into public health initiatives."

In a Brown press release, Dr. Wetle said, "I am honored to receive an award named for Irving Wright who was not only an award-winning cardiovascular researcher, but who also had the foresight to launch a foundation to support basic research on aging. His research contributed to our understanding of anticoagulant therapies by translating basic science into clinical applications. In his memory, my Wright Award lecture will focus on translating research to improve health of older populations."

Dr. Helfand, professor of biology in the Department of Molecular Biology, Cellular Biology, and Biochemistry, will receive the Glenn/AFAR Breakthrough in Gerontology (BIG) Award, which AFAR says provides "timely support to a small number of research projects that are building on early discoveries that show translational potential for clinically-relevant strategies, treatments, and therapeutics addressing human aging and health span."

Sponsored by The Glenn Foundation for Medical Research in collaboration with AFAR, two BIG Awards at $100,000 are given annually, selected through a review process led by committee members from leading research institutions nationwide.

Dr. Helfand said he will use the award for research he is conducting with John Sedivy on how DNA changes with age, sometimes liberating harmful "transposable elements" within our genomes. They are looking to reverse those age-related changes in repressive chromatin to suppress the expression and mobilization of transposable elements in order to extend healthy life span. ❖

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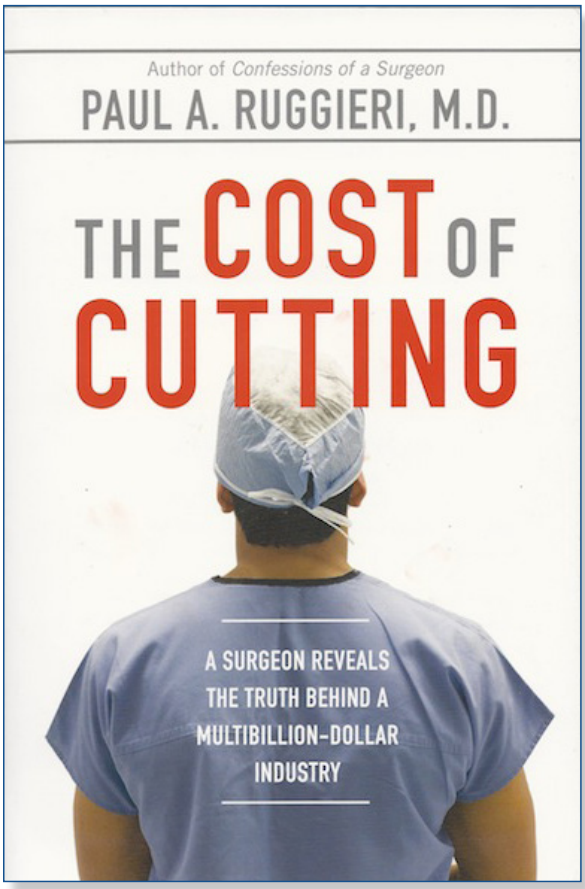
Surgeon probes forces of big business on health care in new book

MARY KORR
RIMJ MANAGING EDITOR



"The Cost of Cutting: A Surgeon Reveals the Truth Behind a Multibillion-Dollar Industry." Publisher: Berkley Trade Publication. Date: Sept. 2, 2014. Pages:320. Available in paperback, e-book.

His Barrington High School English teachers should be proud. Paul A. Ruggieri, MD, (BHS '77), in his latest book, "The Cost of Cutting: A Surgeon Reveals the Truth Behind a Multibillion-Dollar Industry," presents a complex topic – the rising costs of medical care and its impact on patients, physician practices, and hospitals – in a highly readable and candid narrative. It follows his earlier book, "Confessions of a Surgeon," published in 2012.

The book is leavened with humor – especially when Dr. Ruggieri looks 'back-in-the-day' when he was in training, and you could tell which cars belonged to surgeons and which were the lot of primary care docs.

A 1987 graduate of Georgetown University School of Medicine, Dr. Ruggieri did his surgical residency at Barnes Hospital, Washington University School of

Q & A with Paul A. Ruggieri, MD

COURTESY OF PAUL A. RUGGIERI, MD

Author and general surgeon Paul A. Ruggieri, MD

Q. Why did you write about the business side of medicine and who is the primary audience for your new book?

A. I wanted to write about the business side of surgery for several reasons. I had included a chapter on this topic in my last book "Confessions of a Surgeon," but realized there was just too much to say in one chapter so I put the topic on the shelf for a second book. However, the main reason was to inform the public of the business pressures/changes their own physicians were being exposed to. There has been no other time in our health care history than now where business decisions are affecting the delivery of our health care. Business decisions made on federal, state, and community levels involving hospitals and physicians are directly affecting who your primary care physician will be, what surgeon you will be referred to, where you will have your operation, and how much it will cost you. The public needs more transparency on this entire process in order to, I believe, to make informed choices about their health care. My audience for this book is all-inclusive, from the general public to health care professionals.

Q. One of your chapters is called "A Dying Breed," which describes the independent practitioner as a "dinosaur." Do you think consolidation of practices, or practices being bought up by hospitals, is good for patient care?

A. In my opinion, the employed physician is not good for patient care in the end. I also believe it is not good for the physician as well.

Q. If hospitals/health care systems continue the trend of buying up practices, do you think that these burgeoning systems themselves will then become attractive commodities to larger health care systems from out of state or region?

A. Absolutely. Some of these burgeoning hospital systems will become too big, too financially stretched for their own good in the quest to become dominant in their markets. Thus selling to a larger, nationwide hospital chain will be their only salvation in the end.

Q. I have a cousin in New York City who is a retired ophthalmologist. He needed back surgery but it took him months to find a surgeon who would accept Medicare. Have you seen this in New England and do you think it will become a trend – which is bad news for the growing cohort of Baby Boomers?

Medicine, St. Louis, Mo., 1988–1992. He has worked at Truesdale Surgical Associates in Fall River, MA, since 1999. A group of independent practitioners, he acknowledges the breed as "dinosaurs."

"Rest in peace," he advises his fellow dinosaurs in Chapter 3, and notes a 2013 survey in *JAMA* which reported 68% of surgeons are employed and no longer working for themselves.

He questions if an employee is salaried, does it decrease productivity? Or, now that residents by law can work no more than 80 hours a week, does it foster a time-clock mentality? And, do surgeons and other highly-paid subspecialists labor for love or money, or a little bit of both?

With more than 50 million operations performed annually in this country, surgery is big business, the economic lifeblood of hospitals, he reports. "Nowadays, surgeons are more pressured by 'business' factors than ever before – they feel compelled to keep hospital operating rooms busy, to keep their practices going, and to maintain a living," he writes.

Yet in dealing with the demands of modern 'corporate' medicine, ie, relative value units (RVUs), prior authorizations, electronic medical records, etc., he maintains the optimistic view that, frustrations aside, doctors practice for the right reasons.

"For most practicing physicians and surgeons, I believe patient-focused care (not money-focused care) *is* the norm. That should not preclude surgeons from being paid a fair wage for their services."

In the following excerpt, he offers a personal reflection in an OR conversation with co-workers:

> "Hey, I knew I'd make a good living eventually – draining pus, repairing hernias, and taking out diseased organs." I could tell Maria had stopped listening, but I kept going. "Once I finished four years of college, four years of medical school, five years of surgical training, and three years of military obligation – I knew the money would be there at the end if I worked hard enough.
>
> "…At the time of my decision to become a surgeon, what wasn't obvious to me was how hard I would have to work to get there. It also wasn't obvious how hard I would need to work to stay there."

His refuge seems to be in the OR, and something that hasn't changed in his 25 years as a surgeon. "The work itself is truly the reward – as is the gratitude of our patients," he writes. ❖

A. I am not surprised. Yes, this is a national trend and it is occurring everywhere. This refusing to take a patient's insurance for elective surgery is even more pronounced when the insurance is Medicaid. Many practices, especially surgical, are closing their doors to new Medicaid patients. Unfortunately, it is bad news for patient choice overall. Patients will have to work harder to find an experienced surgeon and travel farther in the process.

Q. Are medical students prepared for the business of medicine?

A. Very interesting and appropriate question. I am not sure if medical students need to be inundated with the business side of medicine. They already have enough to learn. Yes, it would be nice to have some introduction to this topic while in medical school. However, I think residents (as part of their training) absolutely need to be aware of the business environment they are about to enter before signing contracts and committing to employment. Many residents today are coming out of training with the intent of working for a hospital system. Like any employee, residents need to be aware of the market for their skills and how they can take advantage of that market. ❖

Excerpt

From Chapter 8: "The Robot Will See You Now"

In a chapter on medical technology in the operating room, Dr. Ruggieri shares a conversation he had with a fellow surgeon in the locker room at the end of the day.

> "How does it feel to be sitting at a television console in the corner of the operating room, manipulating robotic arms in a patient's abdomen?"
>
> He looked at me, half a smile on his face. "Paul, let me be frank. When I tell a patient I can remove her fibroid uterus using robotic arms and small incisions, she's pretty taken with it. Sounds fabulously state of the art.…From an operative standpoint, it is a surgical tour de force. The robotic hand movements are more precise; they have more rotational flexibility. No doubt about it. And the three-dimensional depth perception is better. You can operate with more confidence in small spaces.…Plus, I have to tell you, sitting on a console is much easier on my back."

W&I Obstetrician/Gynecologist publishes book on contraception for medically challenging patients

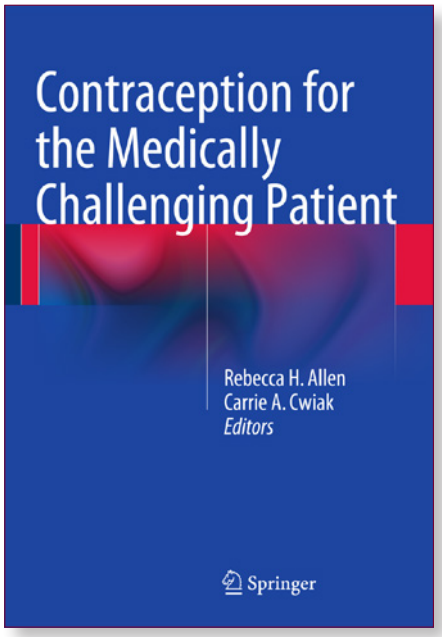
Women with chronic medical conditions can be at higher risk for complications during pregnancy and therefore require specialized preconception and contraceptive care and counseling. However, many medical providers are hesitant to prescribe contraception to these women due to concerns about the safety of various contraceptives with co-existing medical disorders.

REBECCA H. ALLEN, MD, MPH, an obstetrician/gynecologist with expertise in family planning at Women & Infants Hospital of Rhode Island and an assistant professor of obstetrics and gynecology at The Warren Alpert Medical School of Brown University, has published a book that offers advice on how to meet the contraceptive needs of women with chronic medical problems. "Contraception for the Medically Challenging Patient" was edited in collaboration with **CARRIE A. CWIAK, MD, MPH**, Department of Gynecology and Obstetrics, Emory University School of Medicine, Altanta, GA.

Dr. Allen explained, "The hesitance in prescribing contraceptives must be balanced against the fact that certain adverse outcomes and disease progression are likely to be greater during pregnancy than during contraceptive use. Therefore, these women deserve more, not less, family planning care so that an appropriate contraceptive can be found to meet their needs."

"Despite published guidelines by the Centers for Disease Control and Prevention, there is a substantial gap in medical practice regarding the use of contraception in women with chronic medical conditions," she continued. "This book fills that gap and addresses the complex contraceptive needs of today's medically challenging patients with HIV/AIDS, uterine fibroids, obesity, or cardiovascular, neurologic or thyroid diseases, among many others."

The chapter about women with hematologic conditions was co-authored by Dr. Allen's colleague, **TINA RIZACK, MD**, a hematologist/medical oncologist at Women & Infants' Program in Women's Oncology and assistant professor at the Alpert Medical School. ❖



"Contraception for the Medically Challenging Patient" is now available through Springer at http://www.springer.com/medicine/gynecology/book/978-1-4939-1232-2.

Drs. Wenstrom & Carr, fetal medicine specialist at W&I, contribute to Clinical Expert Series in Obstetrics & Gynecology

Series reviews principles, indications and evidence for fetal surgery

PHOTOS: WOMEN & INFANTS HOSPITAL

Katharine D. Wenstrom, MD

PROVIDENCE – **KATHARINE D. WENSTROM, MD**, director of the Division of Maternal-Fetal Medicine at Women & Infants Hospital, co-director of the hospital's Integrated Program for High-Risk Pregnancy, and a professor of obstetrics and gynecology at the Alpert Medical School, and **STEPHEN R. CARR, MD**, director of Women & Infants' Prenatal Diagnosis Center and Maternal-Fetal Medicine Diagnostic Imaging, co-director of the Fetal Treatment Program of New England, and a professor of obstetrics and gynecology at the Alpert Medical School, have published an article as part of a Clinical Expert Series in the October 2014 edition of *Obstetrics & Gynecology*, now available online. The article is entitled "Fetal Surgery: Principles, Indications, and Evidence."

"This article presents the scientific justification for available in utero interventions, evaluates data on their benefits and risks, and offers a framework for future development and refinement of new and more focused interventions that address fetal problems while minimizing maternal risk," said Dr. Carr.

Drs. Carr and Wenstrom concluded that the tremendous resources that are required to perform fetal surgery, including considerable investment in training that is required of a fetal surgeon, together with the relative rarity of most of the conditions for which fetal surgery is attempted, necessitate that the number of fetal surgery centers be limited so that each can care for enough patients to justify their cost and maintain the skills of the fetal interventionist.

Obstetrics & Gynecology is the official publication of the American College of Obstetricians and Gynecologists (the College). ❖

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Appointments

Brown, Lifespan announce new pediatrician-in-chief, dept. chair

Dr. Phyllis Dennery comes to RI in April from Children's Hospital of Philadelphia

PROVIDENCE – Starting next spring, **PHYLLIS DENNERY, MD** will lead pediatric care, teaching and research at the Lifespan health system and Alpert Medical School, the institutions announced October 20.

Dr. Dennery, currently the Chief of the Division of Neonatology and Newborn Services at Children's Hospital of Philadelphia and the University of Pennsylvania, will begin work in Rhode Island on April 15, 2015. She'll serve as Pediatrician-in-Chief and Medical Director at Hasbro Children's Hospital and as Chair of the Department of Pediatrics at Brown.

In Philadelphia, Dr. Dennery oversees more than 300 neonatal intensive care beds in 11 hospitals as well as 90 medical faculty and staff members and 18 fellows. She earned her medical degree at Howard University and performed her residency at Children's Hospital National Medical Center (both in Washington, DC). She then conducted research and taught at Stanford University from 1990 to 2003 before moving to Philadelphia.

As Chair of Pediatrics at Brown, Dr. Dennery will lead academic programs at the hospital for medical students, residents and fellows alike. She will also oversee the advancement of research programs and faculty recruitment.

"We're delighted to welcome Dr. Phyllis Dennery to Hasbro Children's Hospital. Her long tenure as Chief of the Division of Neonatology and Newborn Services at the Children's Hospital of Philadelphia and the University of Pennsylvania Health System demonstrates a deep commitment to excellence that is congruent with the mission of Hasbro Children's Hospital," said Dr. Timothy J. Babineau, President and Chief Executive Officer of Lifespan. "Having served as Associate Division Chief at Stanford University and as tenured faculty at both Stanford and the University of Pennsylvania School of Medicine, Dr. Dennery will continue to elevate our graduate programs for medical students and residents. Her credentials as a clinician, researcher, academic and leader are truly exceptional."

Dr. Babineau added, "Dr. Dennery's appointment comes as Hasbro Children's Hospital celebrates its 20th anniversary — it's a unique institution in Rhode Island and a vital one, and I can think of no one better to lead Hasbro Children's Hospital in the years ahead."

Dr. Jack Elias, Dean of Medicine and Biological Sciences at Brown, said students and patients alike will benefit from Dr. Dennery's work in Rhode Island.

"Her extensive knowledge in Neonatology makes her an excellent candidate for leading and training our students in the field of Pediatrics," Dr. Elias said. "We look forward to the significant contributions she will bring to clinical care, education and research at Alpert Medical School and our affiliated hospitals."

LIFESPAN

Phyllis Dennery, MD

In her medical duties she will oversee clinical programs including centers and clinics for pediatric imaging, hematology/oncology, asthma and allergies, neurodevelopment and the heart.

Dr. Dennery is a member of the Institute of Medicine and has won numerous awards during her career, including the 2014 Marion Spencer Fay award. She serves in many professional and scientific societies, including as an associate editor of the influential journal *Pediatrics.* ❖

Srilakshmi Mitta, MD, joins Center for Obstetric and Consultative Medicine

PROVIDENCE – Obstetric medicine specialist **SRILAKSHMI MITTA, MD**, of Providence, returned to the Women & Infants Center for Obstetric and Consultative Medicine on October 1.

Dr. Mitta is a graduate of the Alpert Medical School. She completed an internship and residency in internal medicine and pediatrics at The Mount Sinai School of Medicine where she earned the title of chief resident of internal medicine and pediatrics. Dr. Mitta also completed an obstetrics medicine fellowship at the Alpert Medical School during which time she saw patients at the Center for Obstetric and Consultative Medicine, where she also served as an attending until 2011.

Dr. Mitta is a member of the North American Society of Obstetric Medicine (NASOM) and International Society of Obstetric Medicine (ISOM). Most recently, she was an assistant professor of clinical medicine at Columbia University Medical Center Department of Medicine, a joint appointment in the Department of Obstetrics and Gynecology.

Board-certified in internal medicine, Dr. Mitta's research and clinical interests include medical education and pre-pregnancy care. ❖

Appointments

Wendy Chen, MD, PhD

Hasbro names new chief of pediatric ophthalmology

Wendy Chen, MD, PhD, to lead newly expanded service line

PROVIDENCE – **WENDY CHEN, MD, PhD**, has been named the new chief of pediatric ophthalmology at Hasbro Children's Hospital, the pediatric division of Rhode Island Hospital. In this role, Dr. Chen will oversee the delivery of comprehensive emergency, outpatient and surgical eye care for children ranging in age from infants to teenagers.

"Dr. Chen brings a high level of expertise to our ophthalmology team," said **MICHAEL E. MIGLIORI, MD**, ophthalmologist-in-chief at Rhode Island Hospital. "She is equipped to handle any eye or vision need that the children in our care may have, from basic vision assessment to surgical consults on our inpatient units."

With the arrival of Dr. Chen, Hasbro Children's Hospital has expanded its ophthalmology services to offer state-of-the-art, child-centered technology in a new clinic space with four exam rooms designed specifically for children.

"Since Rhode Island Hospital began offering ophthalmology services in 1963, pediatric ophthalmology patients have always been accommodated in the same space as adult patients and often treated by the same clinicians. This can be quite challenging because eye exams and eye care are so very different for children versus adults," said Dr. Migliori. "The need for a dedicated pediatric ophthalmology clinic has grown tremendously over the past few years, and we are thrilled that Dr. Chen now provides these services on a full-time basis."

Dr. Chen received her bachelor's degree from Washington University in St. Louis, Missouri, followed by a combined MD and PhD degree from The Warren Alpert Medical School of Brown University. She completed her medical internship and ophthalmology residency at the University of Pittsburgh Medical Center and her pediatric ophthalmology fellowship at The Children's Hospital of Philadelphia.

Dr. Chen's primary areas of expertise are amblyopia, adult and pediatric strabismus, pediatric cataract, pediatric glaucoma and retinopathy of prematurity. Her research interests include neuroplasticity, refinement of screening criteria for retinopathy of prematurity and development of effective teaching methods for medical and surgical ophthalmology.

She is an assistant professor of surgery (ophthalmology) at Alpert Medical School and serves on a multidisciplinary team treating children with complex craniofacial disorders and also participates in the screening of premature infants for retinopathy of prematurity at Women and Infants Hospital. She is active in cross-disciplinary teaching, including pediatrics, neonatology, and emergency medicine.

Dr. Chen is the recipient of numerous awards and is an active member of several professional societies, including the American Academy of Ophthalmology and American Association for Pediatric Ophthalmology and Strabismus, where she serves as the co-chair of the Young Ophthalmologists Committee for Medical Education. ❖

Lifespan names new Rhode Island Hospital president

Margaret M. Van Bree, DrPH, succeeds Timothy J. Babineau, MD, who will remain president and CEO of Lifespan

PROVIDENCE – Lifespan, Rhode Island's largest health system, has named **MARGARET M. VAN BREE, DrPH**, to lead Rhode Island Hospital, and its pediatric division, Hasbro Children's Hospital. Her new position is effective January 5, 2015.

LIFESPAN

Margaret M. Van Bree, DrPH

Van Bree has held positions as chief operating officer at a number of academic medical centers, including the University of Minnesota Medical Center-Fairview and Amplatz Children's Hospital, the University of Virginia Health System, and the University of Wisconsin Hospital and Clinics. Most recently, she served as the senior vice president and chief executive officer of the 864-bed St. Luke's Medical Center, the flagship hospital of St. Luke's Health System and the primary adult private teaching hospital for Baylor College of Medicine.

Van Bree will succeed **TIMOTHY J. BABINEAU, MD**, who has served as Rhode Island Hospital president since 2008 and will continue in his role as president and CEO of the Lifespan system.

"During our extensive national search, Dr. Van Bree stood out because of her experience and leadership in implementing innovative approaches to quality, her knowledge of large academic medical centers and her success in advancing and elevating hospitals' critical service lines," said Dr. Babineau.

Van Bree received her doctoral degree in health systems management from Tulane University and her master's degree in health care administration from the University of Minnesota. ❖

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Neighborhood Health Plan of Rhode Island

Appointments

Souza appointed president of HARI

CRANSTON – **MICHAEL R. SOUZA** has been appointed president of the Hospital Association of Rhode Island (HARI), where he will oversee day-to-day operations of the association and direct member services. Souza had been serving as acting president following the retirement of Edward Quinlan on May 1. He has worked at HARI for more than five years as vice president of finance and senior vice president.

HARI

"The HARI Board of Trustees is proud to have Mike Souza leading the organization," said Dennis D. Keefe, chair of the HARI Board of Trustees and president and CEO of the Care New England Health System. "Mike's background and skills in hospital finance and reimbursement have strengthened the association.He brings vision, determination and a sense of humor to his work. He is the ideal person to lead HARI into the future."

"I look forward to steering the association and its members through this tumultuous time of change in health care," said Souza. "Rhode Islanders count on hospitals to be there in their greatest times of need. We must ensure hospitals are able to continue their important mission."

Souza joined HARI in 2009 from Signature Healthcare in Brockton, MA, where he served as corporate controller and was responsible for the accounting, reporting and control functions of the corporation's various entities. He also served as director of financial planning at Landmark Medical Center. Souza was awarded a master of science management degree by Bridgewater State College. He received a bachelor of arts degree in humanities and social sciences from the University of Massachusetts at Dartmouth. The Healthcare Financial Management Association (HFMA) has awarded him the certification of fellow. He is also a member of the Board of Directors of the Massachusetts-Rhode Island Chapter of HFMA. ❖

Rebecca Mclean, PhD; Meredith Amaya-Hodges, PhD, appointed to Memorial

PAWTUCKET – Memorial Hospital of Rhode Island recently appointed **REBECCA MCLEAN, PhD**, and **MEREDITH AMAYA-HODGES, PhD**, to its medical staff in the Department of Pediatrics at the New England Pediatric Institute of Neurodevelopment, formerly known as the Neurodevelopmental Center. Both are pediatric neuropsychologists who specialize in evaluating children and adolescents with neurodevelopmental, psychological, learning, behavioral and/or medical conditions.

Rebecca McLean, PhD

Meredith Amaya-Hodges, PhD

PHOTOS: MEMORIAL HOSPITAL OF RI

Dr. McLean earned her PhD in clinical psychology, with a focus in neuropsychology, from Suffolk University in Boston, MA. She completed her internship in clinical psychology, neuropsychology track, and a two-year post-doctoral fellowship in clinical psychology, pediatric neuropsychology track, through the Alpert Medical School.

Dr. Amaya-Hodges earned her PhD in clinical psychology, child/adolescent focus, from Northwestern University's Feinberg School of Medicine, Chicago, IL. She completed her internship in pediatric psychology and two-year post-doctoral fellowship in pediatric neuropsychology, concussion track, at Children's National Health System, Washington, DC.

McLean evaluates children with a broad range of neurodevelopmental disabilities (e.g., ADHD, learning disability, communication disorders, intellectual disability). She also sees children with anxiety, behavioral difficulties, and medical conditions that can impact thinking (e.g., prematurity, sleep disorders, genetic syndromes, concussion). She has particular interests in children and adolescents with Autism Spectrum Disorder (ASD), along with associated medical and genetic conditions. She is trained in the use of the Autism Diagnostic Observation Schedule (ADOS-2) and is a member of the Rhode Island Consortium for Autism Research and Treatment (RI-CART). Her research has focused on the relationship between aspects of neuropsychological functioning and clinical outcomes in individuals with ASD and Attention Deficit Hyperactivity Disorder (ADHD).

Amaya-Hodge has experience in working with children with a variety of developmental, psychological, and medical diagnoses. She has specialized training in the evaluation and management of concussions and other acquired brain injuries. She also focuses on assessment of children with genetic conditions that may impact neurodevelopment. Other areas of interest include depression, anxiety, and obsessive-compulsive disorder. ❖

Natalia Lukankina, MD, appointed to Memorial medical staff

MEMORIAL HOSPITAL OF RI

Natalia Lukankina, MD

PAWTUCKET – Memorial Hospital of Rhode Island recently appointed **NATALIA LUKANKINA, MD**, to its medical staff in the Department of Pediatrics.

Dr. Lukankina earned her medical degree from Voronez State Medical Academy, Russia. She completed her residency in pediatrics at Albany Medical Center and went on to complete a developmental behavioral fellowship at Rhode Island Hospital.

Fluent in Russian, Dr. Lukankina is a member of the American Academy of Pediatrics, American Medical Association and the Society of Developmental Behavioral Pediatrics.

Her clinical interests include: attention deficit hyperactivity disorder, autism, and pediatric sleep disorders. ❖

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Recognition

Rami Kantor, MD, receives Bruce M. Selya excellence in research award

PROVIDENCE – Lifespan has honored **RAMI KANTOR, MD**, an infectious disease expert, with the 2014 Bruce M. Selya Award for Excellence in Research. Named for Judge Bruce M. Selya of the United States Court of Appeals for the First Circuit and a former Lifespan chairman, the award is presented annually for outstanding biomedical research among Lifespan partner hospitals.

Dr. Kantor, a researcher and clinician, is an internal medicine and infectious diseases physician at Rhode Island and The Miriam hospitals, as well as an associate professor of medicine at The Warren Alpert Medical School at Brown University. He is the director of research for the Brown-Kenya Program and director of the Immunology Center and HIV Drug Resistance Laboratory at The Miriam Hospital.

"Dr. Kantor's commitment to the improvement of the HIV-infected community, not only here in Rhode Island, but also in the resource-limited countries where HIV is most prevalent, is commendable," said Peggy McGill, director of research administration for Lifespan. "His clinical experiences and scientific curiosity are giving rise to global advances in HIV research."

Major themes of Dr. Kantor's research include HIV diversity, treatment monitoring, and the evolution of drug resistance. Among his current projects are: an examination of HIV drug resistance, transmission and diversity in adults and children in Rhode Island and in resource-limited settings; development of advanced methods to detect and interpret HIV drug resistance and investigate HIV transmission; establishment of point-of-care platforms for HIV drug resistance testing in limited settings; and monitoring of HIV-infected patients with limited resources.

LIFESPAN

The Hon. Bruce M. Selya presents Rami Kantor, MD, with the 2014 Award for Excellence in Research.

Dr. Kantor's research has led him to India, Thailand, China, Kenya, Ghana, Ethiopia, Cape Verde and Israel. He is a scientific reviewer for *PLoS Medicine*, *Clinical Infectious Diseases*, and *JAMA* medical journals, and was recently invited to serve as a standing member of the AIDS Clinical Studies and Epidemiology Study Section of the National Institutes of Health. He has participated in local, national and international organizations including the AIDS Clinical Trials Group, the World Health Organization HIV Drug Resistance Network, Center for AIDS Research Retrovirology and Biostatistics Cores, and TREAT Asia.

Dr. Kantor demonstrates excellence in research as exemplified by the incredible health-relatedness of his research to the local, national and international HIV-infected community," said Louis B. Rice, MD, physician-in-chief at Rhode Island and The Miriam hospitals. "The impact of his research is high and as he has done in the past, I am confident that he will continue to inform treatment policy and improve HIV patient care worldwide." ❖

Adult/Geriatric Psychiatrists
Southeastern, Massachusetts

Good Samaritan Medical Center, Saint Anne's Hospital and Morton Hospital are seeking BC/BE Adult and/or Geriatric BC/BE psychiatrists to join our expanding, regionally cohesive Behavioral Health departments along the Route 24 corridor of Southeastern Massachusetts. These positions in each of our hospitals will be on our geriatric psychiatric units with some adult and geriatric consultation in the ER and adult Med/Surg units. The Psychiatrists are responsible for oversight of the behavioral health programs as well as for the monitoring and evaluation of quality assurance. The Psychiatrists will provide direct psychiatric services through comprehensive evaluation, diagnosis, treatment planning and treatment of patients assigned to the units at each location.

Additional benefits of these positions Include:

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- Our Psychiatrists have strong medical back up through a strong collaborative effort with our Hospitalist program.
- Opportunity to work with a clinically sound and experienced multidisciplinary team at each hospital (including nurses, social workers and allied health professionals).
- Opportunity to build one's experience and leadership skills within a fast-growing, dynamic service line.
- Experience with the largest provider of inpatient behavioral health services in eastern Massachusetts.

**** Medical Directorships available for experienced, qualified candidates.**

In a recent article published August 7th, 2014 in the Boston Globe, it was highlighted that Steward Health Care System is spending millions to open new psychiatric units in its Massachusetts hospitals, filling a gap in mental health care and marking a reversal from the recent years in which hospitals had little interest in expanding these services. Steward has added 40 beds for adults with mental illness or substance abuse disorders in the past nine months, and plans to expand by another 30 beds this year — a total increase of 21 percent.

Steward Health Care System is the largest fully integrated community care organization and community hospital network in New England, headquartered in Boston, Massachusetts.

You can view all our openings, apply and learn more about Steward at:
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For inquiries please contact:
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Steward Health Care System
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Email: Jacqueline.Crowell@steward.org

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Recognition

Gamache, VP of Extended Care for CharterCARE, Named President of Eden Alternative Board

Focus is on changing the culture of elder care

CHARTERCARE HEALTH PARTNERS

Richard Gamache

PROVIDENCE – **RICHARD GAMACHE**, Vice-President of Extended Care for CharterCARE Health Partners, has been named President of the Board of Directors of the Eden Alternative, an international, non-profit organization dedicated to creating quality of life for elders and their care partners, wherever they may live.

CharterCARE Health Partners is the corporate parent of Roger Williams Medical Center and St. Joseph Health Services of Rhode Island.

He has been a board member of the Eden Alternative since 2009, most recently serving as treasurer. Gamache serves as administrator of Elmhurst Extended Care, Rhode Island's only Eden Alternative community. He is a Certified Eden Alternative Educator and Eden Mentor, and under his direction, Elmhurst has been practicing the Eden Alternative philosophy since 2002.

"This is a personal and professional honor for me, given how much respect and admiration I have for my fellow board members and all people, worldwide, who are practicing The Eden Alternative in an effort to make lives better for elders and those who care for them," said Gamache. "In my new role, I will work with the board and our CEO Chris Perna to collectively provide guidance and leadership to our organization and the people we serve."

Focused on changing the culture of elder care since the early 1990s, the Eden Alternative approach to person-directed care initially came to life in nursing homes and has since expanded its reach to all care settings, including home care and residential care for people living with different abilities.

Gamache has more than 25 years of experience as a healthcare executive in the field of elder care. He is a licensed and nationally certified nursing home administrator who has worked in Massachusetts, Rhode Island, and Connecticut, including multi-site management of nine facilities in three states. He has achieved the rank of Fellow within the American College of Health Care Administrators (ACHCA) and is the immediate past-president of the Rhode Island chapter. Currently, he serves on the national education committee for the ACHCA.

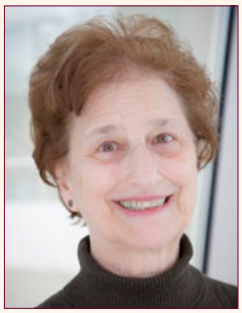
He is a founding member and past chair of "RI Generations," a partnership to promote person-centered care in RI nursing homes and is also the immediate past chair of the Rhode Island Health Care Association.

This year, the ACHCA honored Gamache with the 2014 Eli Pick Facility Leadership Award.

Gamache holds a Master of Science in Health Services Administration from Salve Regina University, and a BA in History from UMass/Dartmouth. ❖

Pioneer in Hearing and Language Development in Children Named 2014 Landmark Award Winner

PROVIDENCE – **BETTY R. VOHR, MD, FAAP**, director of the Neonatal Follow-Up Program at Women & Infants Hospital and professor of pediatrics at the Alpert Medical School, was awarded the annual Landmark Award of the Section on Perinatal Pediatrics for her efforts in establishing the first Universal Newborn Hearing Screening Program in the United States. This program has now been replicated across the country as a means of detecting congenital hearing loss as early as possible for auditory intervention to optimize language development in children. Dr. Vohr received the award at the annual Section on Perinatal Pediatrics National Conference and Exhibition in San Diego, CA.



W&I HOSPITAL

Betty R. Vohr, MD, FAAP

Prior to the establishment of the newborn screening program, screening for hearing impairment in infants and children was done by practitioners in routine physicals. Dr. Vohr's passion to see the process of detection improve drove the acquisition of funding from the Maternal and Child Health and Department of Education to test and study universal newborn hearing screening. The results demonstrated positive and preventive effects leading to national recognition. Rhode Island subsequently became the first state to successfully implement a statewide universal newborn hearing screening program under Dr. Vohr's direction.

Dr. Vohr said, "All Rhode Islanders can be proud that the study demonstrating the feasibility of newborn hearing screen was done in Rhode Island between 1989 and 1991, and that RI was the first state to mandate and achieve universal newborn hearing screening. Today more than 97% of newborns in the U.S. are screened. The ultimate reward is seeing the wonderful outcomes that are now possible for early identified children."

Throughout her career dedicated to infant hearing and newborn health, Dr. Vohr has served on numerous committees including serving as an American Academy of Pediatrics (AAP) delegate and chair of the Joint Committee on Infant Hearing, the AAP Task Force on Improving the Effectiveness of Newborn Hearing Screening, Diagnosis and Intervention, and she has been a Rhode Island AAP Chapter Champion for Early Hearing Detection and Intervention.

The Section on Perinatal Pediatrics was founded in 1974 for the purpose of improving the care of pregnant women, fetuses, and newborn infants by providing an educational forum for the discussion of problems relating to pregnancy, and neonatal medicine. The American Academy of Pediatrics (AAP) Board of Directors receives recommendations from the section on programs, policy statements, and other matters relating to the fetus and newborn. "I was incredibly honored to receive the 2014 AAP Perinatal Section Landmark Award. Universal newborn hearing screening would not have been possible without the support, enthusiasm and commitment of so many professionals and parents of children with hearing loss," said Dr. Vohr. ❖

Recognition

Brown names DEANS Award recipients

PROVIDENCE – The first Dean's Emerging Areas of New Science (DEANS) Awards have been awarded to Brown University faculty members. Announced earlier this year, the DEANS Awards will foster scientific discovery through partnerships between basic science faculty in the Division of Biology and Medicine and Alpert Medical School clinical faculty members. The intent is for the translational nature of these awards to lead to advances in pathogenesis and ultimately medical care. The following projects each received an $80,000 grant.

BRENNA ANDERSON, MD (Obstetrics and Gynecology) and **SUE HUSE, PhD** (Pathology and Laboratory Medicine) The impact of vaginal microbiome on HIV infectivity among pregnant and non-pregnant women

RICHARD BENNETT, PhD (Molecular Microbiology & Immunology) and **JOSEPH BLISS, MD, PhD** (Pediatrics/Neonatology) Defining the Factors Responsible for Persistent Candidemia by C. albicans

ADAM CHODOBSKI, PhD (Emergency Medicine) and **JOHN MARSHALL, PhD** (Molecular Pharmacology, Physiology & Biotechnology) Development of a New Treatment for TBI

GAURAV CHOUDHARY, MD (Medicine) and **EDWARD HAWROT, PhD** (Molecular Pharmacology, Physiology and Biotechnology) Nicotinic Acetylcholine Receptors in Right Ventricular Fibrosis

KAREEN L. K. COULOMBE, PhD (Engineering) and **ULRIKE MENDE, MD** (Medicine/Cardiovascular Research Center) Functional Integration of Aligned Engineered Cardiac Tissue in Infarcted Hearts

ERIC DARLING, PhD (Molecular Pharmacology, Physiology and Biotechnology) and **YUPENG CHEN, PhD** (Orthopaedics) Predicting post-traumatic osteoarthritis via in vivo biomarkers of inflammation

BETH BURGWYN FUCHS, PhD (Medicine) and **ANITA SHUKLA, PhD** (Engineering) Anti-microbial activity of auranofin and assessment of a coated delivery device

STEPHEN L. HELFAND, MD (Molecular, Cellular Biology and Biochemistry) and **BHARAT RAMRATNAM, MD** (Medicine) Retroviral inhibitors: effects on retrotransposons and aging in flies and humans

DIANE HOFFMAN-KIM, PhD (Molecular Pharmacology, Physiology and Biotechnology) and **CARL SAAB, PhD** (Neurosurgery) Tissue Engineering Neuroma Prevention & Nerve Repair

AMANDA JAMIESON, PhD (Molecular, Microbiology and Immunology) and **JORGE ALBINA, MD** (Surgery) Post-surgical pneumonia & development of wound repair macrophages

STEPHANIE JONES, PhD (Neuroscience) and **WAEL ASAAD, MD, PhD** (Neurosurgery) Deep Brain Stimulation to Reduce Beta Rhythms in Parkinson's Disease Guided By Neural Modeling

RAMI KANTOR, MD (Medicine/Infectious Disease) and **CASEY DUNN, PhD** (Ecology and Evolutionary Biology)Extended Phylogenetic Inference of HIV Transmission Networks

DEREK L. MERCK, PhD (Diagnostic Imaging), **DAMIAN DUPUY, MD** (Diagnostic Imaging), and **BEN KIMIA, PhD** (Engineering) Thermal Models for Ablation Treatment Planning

RICHARD G. MOORE, MD (Obstetrics and Gynecology) and **CHRISTOPH SCHORL, PhD** (Molecular and Cellular Biology and Biochemistry) Establish Genomic Targets of HE4 & Antisense Therapy for Treatment of Ovarian Cancer

REBECCA PAGE, PhD (Molecular and Cellular Biology and Biochemistry) and **ELEFTHERIOS MYLONAKIS, MD** (Medicine/Infectious Disease) Novel Paradigms for the Treatment of Biofilm Forming Pathogens

SHARON ROUNDS, MD (Medicine/Pulmonary and Critical Care) and **DAVID RAND, PhD** (Ecology and Evolutionary Biology) Cigarette Smoke Effects on Mitochondria—From Flies to Lungs

JEROME N. SANES, PhD (Neuroscience) and **BENJAMIN D. GREENBERG, MD, PhD** (Psychiatry and Human Behavior) Probing Inflexibility: Mechanisms for Change of Mind in Obsessive Compulsive Disorder

DAVID SHEINBERG, PhD (Neuroscience) and **KATHARINE A. PHILLIPS, MD** (Psychiatry and Human Behavior) Modification of Perception in Body Dysmorphic Disorder and Neural Correlates

EDWARD G. WALSH, PhD (Neuroscience) and **BARBARA S. STONESTREET, MD** (Pediatrics/Neonatology) Neuroprotective Effects of Novel Anti-HMGB1 Antibody on Neonatal Brain Ischemia

KRISTI WHARTON, PhD (Molecular, Cellular Biology and Biochemistry), **HELENA TAYLOR, MD, PhD** (Surgery/Plastic Surgery), and **STEPHEN SULLIVAN, MD, MPH** (Surgery/Plastic Surgery) Importance of BMP Processing in Craniofacial Development

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Medicine and its Many Numbers

STANLEY M. ARONSON, MD

MEDICINE, IN THE PAST, HAD BEEN LITTLE MORE THAN THE ART OF compassion, counseling and cautious prophecy until the elements of comparison and quantification were appended; and only then did medicine enter the realm of the sciences.

Numbers began to creep into the daily language of medicine even when its practitioners were still consulting in Greek, and later, in Latin. And thus, the historical digitalization of clinical discourse was strewn with Greco-Latin roots, prefixes and suffixes, much persisting in contemporary medical vocabulary.

English	Latin	Greek
One-half	semi-	hemi-
One	uni-	mono-
Two	bi-	di-
Three	terti-	tri-
Four	quadri-	tetra-
Five	quinqui-	penta-
Six	sexa-	hexa-
Seven	septa-	hepta-
Eight	octo-	octo-
Nine	novem-	ennea-
Ten	decem-	deca-
One hundred	centi-	hecto-
Thousand	milli-	kilo-

The Greek word for many (*polus*) gave rise to an assemblage of medical terms including polydipsia, polyuria and polydactylism. The Greek word for few (*oligos*) yielded terms such as oligodendroglia, oligomorphic and oligoruria. And then there are a few numerically oriented prefixes such as the Greek, *proto-*, meaning first as in protoplasm, protopathic and prototype. And the Greek, *deutero-*, meaning second as in deuteroplasm, deuteropara and deuterium.

The classical Mediterranean languages – Greek and Latin and a marginal touch of Arabic and Hebrew – joined to form a comprehensive transnational language suitable for medical students anywhere in Europe. It was, and remains, the *lingua franca* of the profession of medicine.

PAGE FROM *CATOPTRUM MICROSCOPICUM*, JOHANN REMMELIN, 1619 FROM THE RIMS COLLECTION AT THE HAY LIBRARY

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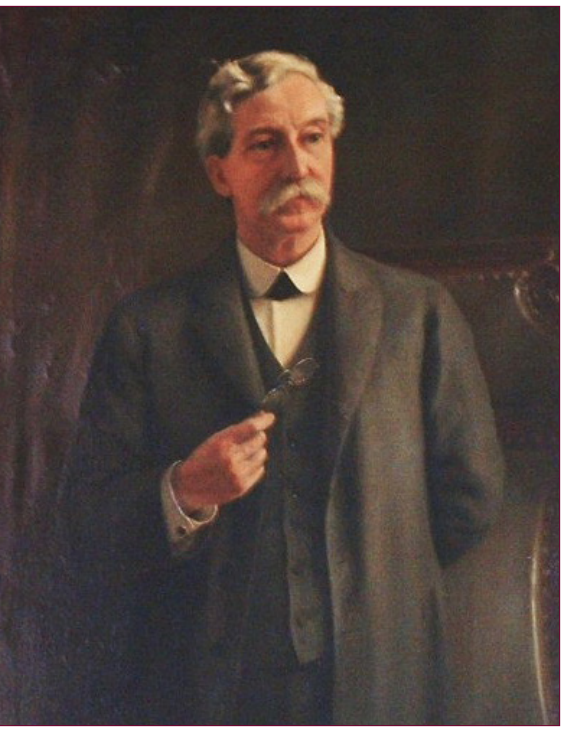
November 1902: Lucius F. C. Garvin, MD, elected governor

'He worked for justice'

MARY KORR
RIMJ MANAGING EDITOR



Formal portrait of Gov. Lucius F. C. Garvin, MD. The Rhode Island Heritage Hall of Fame inducted Dr. Garvin in 2008.

In November 1902, Lucius F. C. Garvin, MD, was elected governor of Rhode Island. His road to politics and his reform agenda were born in the Lonsdale mills. After earning his MD at Harvard Medical School in 1867, he took a position as company physician at The Lonsdale Company, a complex of mills, machine shops and blocks of workers' homes which engulfed three towns.

As company physician, he was on call day and night. Dr. Garvin rounded in his buggy until 1899, when he swapped his horses for a bicycle. But it was the plight of the mill children which led him into the political arena, and eventually to the State House, where he served as governor for two terms. "Impoverished circumstances drive children to wage earning," he stated in an address to his colleagues at the Rhode Island Medical Society.

At the American Public Health Association in 1876, he spoke on the most common forms of mill injuries – limbs lacerated by moving gears, which resulted in amputation or permanent maiming. He presented 36 cases; six of the victims were children from 8 to 11 years old, though the hiring of anyone under 12 was illegal by state law.

"Experience shows that these iron cogs…catching the side or tip of the operative's finger, without warning, draw it rapidly in, while, like a hungry shark, the second set, reaching farther on, takes a better hold and again draws in – the first laceration of the flesh being but a prelude to crushing the bone."

He also reported on the high rate of infant mortality among working mothers, and the prevalence of "anemia, dyspepsia, and phthisis pulmonalis." He described one night call to an attic bedroom where the "surcharged atmosphere…calls to mind the effluvium which arose from the hatchway of ships used for transporting soldiers during the late war." (Dr. Garvin was a Civil War veteran who had contracted a prolonged bout of malaria while serving.)

He proposed a resolution supporting mandatory half-day schooling for those under 16, frequent inspections of the mills and mill houses, an authorized public health officer to inspect the milk supply, tougher child labor laws and stricter enforcement of current law. The Blackstone River, he asserted, was a sewer.

Dr. Garvin first entered politics when he was elected Cumberland's representative (Democrat) in the state legislature in 1883, where he championed pro-labor legislation, voting reform, and proportional representation based on population. He served 16 terms as a lawmaker.

In 1897, the *Pawtucket Gazette and Chronicle* credited his efforts in helping pass legislation for a 10-hour work day for conductors and motormen, ballot reform, the establishment of a Bureau of Industrial Statistics, and a law on factory inspections with enforcement powers.

In 1902, he launched his second gubernatorial fight. The national pro-labor newspaper *Outlook* noted his stunning victory, after a loss the year earlier: "Powerful boss rule may be, and often is, overthrown by patient, persistent and upright effort to guard and preserve the real interests of the public. What Dr. Garvin will do in the executive branch only time will tell."

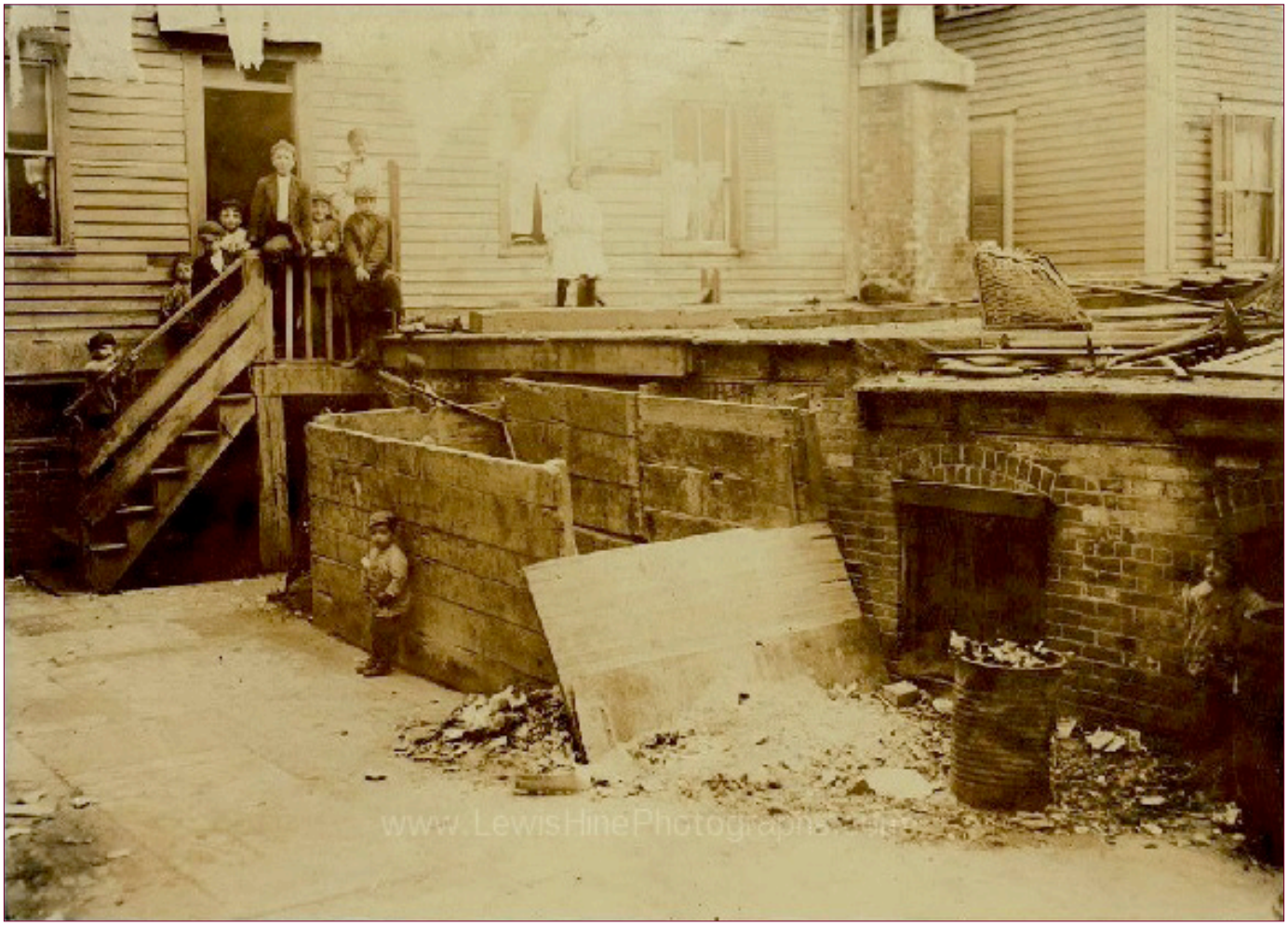
Historians relate the lack of veto and appointment powers enacted by Charles "Boss" Brayton and his Republican cronies robbed Gov. Garvin of any effectiveness during his two terms (1903–1905).

Dr. Garvin would later recall the life of a country physician was "no bed of roses." By his count, he had delivered over a thousand babies in Lonsdale, hurrying to bedsides in the worst of winters. He charged $6 per delivery ($8 at night), which included several post-natal visits. Yet for 55 years, the practice of medicine was the one constant in Dr. Garvin's life. Known to have heart disease, he died suddenly at work on October 2, 1922. His tombstone in Swan Point Cemetery is inscribed, "He worked for justice. ❖

PROVIDENCE DAILY JOURNAL, JANUARY 17, 1904

Editorial cartoon from a Providence newspaper reflected the criticism of his Republican opponents.

The public's health in 1912–1913, Rhode Island



On November 26, 1912, renowned photojournalist Lewis Wickes Hine (1874–1940) took these photographs.

The photo above shows the entrance to "the crowded, dirty house of a midwife, rear tenement on Spruce Street, Providence," according to Hine's description.

The photo at right is of a sick worker receiving first aid in a room set apart for hospital use in the Brym & Marsh manufacturing plant in Pawtucket, which made electric bulbs. The photograph was one of many Rhode Island mill workers Hine chronicled for a national child welfare exhibit in 1912–1913. The sign atop the chest at left reads: "Johnson's First Aid Cabinet … Keep Locked."

PHOTOS: LIBRARY OF CONGRESS