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The Times They Are a Changin’

By Robert E. Van Demark, Jr., MD
SDSMA President

It appears as though the lyrics to the song, “The Times They Are a Changin’” by the Nobel laureate Bob Dylan still hold true today. However, disruption associated with change is not something new and created in this century as the Greek philosopher Heraclitus (535-475 BC) is known for the statement that “the only constant is change.”

In February, I joined the South Dakota State Medical Association (SDSMA) executive leadership (Drs. Tom Hermann and Mary Carpenter, and CEO Barb Smith) at the American Medical Association (AMA) National Advocacy Conference in Washington, D.C. We heard a variety of speakers with most of the discussion dealing with the Affordable Care Act (ACA) and the proposed repeal/replace debate. The speakers included Sen. John Barrasso (R-WY), Rep. Charlie Dent (R-PA), Sen. Ron Wyden (D-OR), Rep. Kevin Brady (R-TX), and Mark Halperin, former co-managing editor of Bloomberg Politics.

The AMA position on health care reform is reasonable: to provide health insurance for all Americans, pluralism, freedom of choice, freedom of practice, and universal access for patients. While in D.C., we met with our congressional delegates and voiced our concerns regarding possible new legislation.

At this time, it is important to note that the SDSMA never took a position of support for the ACA. When the ACA was passed, it had a provision protecting individuals with preexisting medical conditions. Prior to the ACA, such individuals were routinely denied coverage and/or priced out of affordable coverage. Repealing the ACA may make coverage completely unaffordable to people with preexisting conditions which will lead to patients losing their coverage. We as an association are also quite concerned about the potential for millions of Americans to lose their access to quality, affordable health insurance.

A lot has happened since our February meeting with our congressional delegates in regard to both the context of the bill language and the status of their efforts to repeal it.

As advocates for patients and physicians of South Dakota, the SDSMA believes in:

- The role of physicians in the determination of health care policy;
- A health care system that provides the greatest possible access to basic quality health care that is affordable for all South Dakota citizens;
- A health care system that makes available affordable plans for catastrophic health care coverage to avoid financial ruin of individuals and families;
- A health care delivery system that meets the highest standards of care for acute and chronic disease states while addressing disease prevention, wellness and public health;
- The ethical imperative of providing health care to individuals, responsible stewardship of community resources, and the importance of personal health responsibility;
- Cost management by all stakeholders – patients, providers, and payers – to ensure a workable, affordable and sustainable health care system;
- The development of a health care system that can provide effective, efficient, and appropriate health care without administrative barriers and unreasonable overhead costs;
- A shared public/private effort to provide access to and financing for appropriate health services and a system which will allow individuals/employers to purchase additional services or insurance;
- Sufficient government funding for public health and other essential medical services to include disaster medicine and trauma care; and
- Comprehensive medical liability reform to ensure access to quality health care.

In closing, I would recommend an article entitled “Getting There from Here” by Atul Gawande in The New Yorker. Dr. Gawande is a general surgeon at the Brigham and Women’s Hospital in Boston. Written in 2009, the article provides an excellent outline of the differences of the universal health care systems of the Western nations, and how historical events helped define them.

Yes, the “Times Are A Changin.” However, regardless of the challenges we face as an organization, as individuals, employees of a health care system or an independent provider, we should all strive to do no harm, provide the best care possible for our patients, and to honor and respect the medical profession.

I look forward to the coming year and the changes we will see.

REFERENCES

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IS IT A GOOD IDEA TO “BUY WHAT YOU KNOW”?  
This famous recommendation originated with an extremely successful investor, Peter Lynch. The idea is to invest your dollars in companies you either work for or are extremely familiar with, which seems to make sense. Trouble is, this loads up one basket with way too many eggs. Investing in assets that have a high correlation with someone’s human capital (aka paycheck) puts an individual’s livelihood and future at increased – and unnecessary – risk. Investing heavily in the stock of one’s employer or businesses you closely associate with likely lacks diversification. Employees of companies like Enron and WorldCom found out how costly a mistake that can be. No matter how well you feel you know your business, always be careful about allowing your confidence level to bleed into your investment strategy. All it takes is some bad news to weigh down an industry and its return...or one individual inside the walls of a particular company to do something irresponsible and create financial chaos. Stay diversified.
The New Genetic Frontier: CRISPR-Cas9?

By Keith Hansen, MD
Editor, South Dakota Medicine

In 2016, one of the first human CRISPR-Cas9 clinical trials in non-small cell lung cancer was launched in China. This trial involved removing immune cells from patients with non-small cell lung cancer, modifying the cells by removing the gene that encodes the PD-1 protein, expanding the number of modified cells in-vitro, and then reintroducing these cells back into the patients. The PD-1 protein functions in normal immune cells to decrease their response to the cancerous cells which allows the cancer cells to proliferate. PD-1 was a reasonable choice for these trials as PD-1 inhibitors are already on the market for treatment of cancer, including non-small cell lung cancer. Shortly after the introduction of this first trial, the Chinese have launched another trial using this technology in patients with gastric cancer, lymphoma and nasopharyngeal cancer. In the U.S., scientists at the University of Pennsylvania have recently received approval from the National Institutes of Health and are awaiting Food and Drug Administration (FDA) approval for a trial using CRISPR-Cas9 technology to alter T cells from subjects with several types of cancer. In this trial not only will they remove the gene that encodes PD-1 but they will insert a gene for a receptor found on some cancer cells. In other words, not only will they constitutively activate the T cells but they will direct them to the appropriate cancer cells to destroy.

What is CRISPR-Cas9? CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats, while Cas9 is an endonuclease. CRISPR-Cas9 allows for genome editing by targeting specific stretches of DNA which can then be modified at these specific locations. CRISPR-Cas9 naturally plays an integral role in bacterial defense against viruses, aka bacteriophages. The structure of CRISPR includes repeating palindromic sequences separated by specific sequences of genetic code known as spacers. These spacers are specific sequences of genetic code arising from previous viral invaders and serve as a memory for the immune system, which allows the bacteria to mount a rapid, aggressive response to a repeat infection. By altering these precise spacer sequences one can direct the CRISPR-Cas9 to a specific area of the genome.

There are a number of potential scientific areas of investigation that genome editing with CRISPR-Cas9 can benefit: basic science, somatic cell editing, and germ cell editing. For basic science, the ability to precisely, reproducibly, and efficiently edit the genome will improve our understanding of gene function, early development, stem cells, cancer, and many other areas of biology and medicine. Somatic cell editing has the potential to improve our understanding and treatment of diseases. As noted above, the first trials of somatic cell genome editing for the treatment of cancer are already under way. Other potential areas include Mendelian diseases and some adult onset chronic medical conditions. While Mendelian diseases have a known single gene mutation, many adult diseases have a number of different genes and environmental influences making them more difficult to “edit.” Another potential area of use could be in improving antibiotic sensitivity or possibly as an agent to directly attack an invading microorganism, in other words specifically replace antibiotics.

One of the more controversial areas is in editing the germline. Areas where genome editing could be used with the germline include treatment or prevention of disease, as well as phenotypic enhancement like eye color, muscle strength, height, and other enrichments. Since germline editing will be inherited by generations to come the importance of safety becomes paramount. Recent studies have suggested that genome editing may have the unwanted side effect of multiple edits throughout the non-targeted genome.

The U.S. National Academies of Sciences and Medicine has made recommendations about applying human genome editing to these various areas. They suggest that genome editing should continue in basic science for both somatic and germlines. They also suggest that somatic cell trials should proceed under existing frameworks and guidelines. For editing of the germline to treat or prevent genetic diseases, they note the critical importance of safety and moving forward with caution because of the unknowns. The report notes that genome editing of the germline for enhancement should not be approved at this time. Currently in the U.S., federal funds cannot be used for clinical research into germline editing. However, in other countries these limitations do not exist. In China, one of the first trials of germline editing involving the beta globin gene for possible treatment of beta thalassemia was conducted in triploid embryos (non-viable embryos) and recently published. For the interested reader, I would suggest a recent article on genome editing which appeared in Nanoethics reviews CRISPR-Cas9 editing and the many ethical dilemmas.

REFERENCES

Point-Counterpoint: Genotyping for SSRIs

By Natasha Petry, PharmD, BCACP; and Lindsay J. Hines, PhD

Introduction

Earlier this year, South Dakota Medicine launched a series of monthly articles dedicated to reviewing the pros and cons of gene-based drug dosing. The first article in this series was a point-counterpoint argument by two local content experts discussing the pros and cons of cytochrome P450 2C19 (CYP2C19) genotyping for patients taking clopidogrel. Because the CYP2C19 enzyme also metabolizes 5-10 percent of all prescription medications, we now present a follow-up article, exploring the impact of CYP2C19 gene variants on a second class of drugs, the antidepressants. Because antidepressants are metabolized by multiple cytochromes P450 (CYP enzymes), gene-based dosing models need to be expanded to include inherited variation in more than one gene.

Natasha Petry, PharmD, BCACP: CYP genotyping helps providers anticipate response to antidepressants

There are multiple classes of drugs used to treat depression. Selective serotonin reuptake inhibitors (SSRIs) are among the most commonly prescribed antidepressants. They are also used to treat posttraumatic stress disorder, premenstrual dysphoric disorder, social anxiety disorder, general anxiety disorder, obsessive-compulsive disorder, and panic disorders. Some of these uses are off-label. At present, there are several drugs available in this class. Historically, the most commonly prescribed SSRIs have been fluoxetine, fluvoxamine, paroxetine, sertraline, citalopram, and escitalopram. All work by blocking the reuptake of serotonin in the brain, increasing synaptic serotonin concentrations and enhancing serotonergic activity in the central nervous system (CNS).

Serotonin is thought to be associated with feelings of happiness. Although similar drugs have been developed like the serotonin-norepinephrine reuptake inhibitors (SNRIs), including duloxetine and venlafaxine, there are some mechanistic differences between SSRIs and SNRIs that impact their side effect profile. Although both SSRIs and SNRIs inhibit serotonin reuptake, SNRIs also affect the reuptake of norepinephrine. As such, SNRIs are more likely to cause adrenergic side effects (e.g., agitation); they may also unmask anticholinergic side effects (e.g., constipation and dry mouth). While SSRIs and SNRIs seem to have similar efficacy, the SSRIs may be better tolerated by some patients.

Depression is a common problem. Between 5-10 percent of adult primary care patients suffer from major depressive disorder. The percentage of patients suffering from depression following a hospital stay for a critical condition is about five times that number. Between 1991-2011, SSRI use increased nearly sixfold. Unfortunately, about 40 percent of patients being started on antidepressant do not see any improvement with monotherapy. These patients may need to add an alternative medication due to therapeutic failure. Further, while 60 percent of patients will see improvement, they could experience an adverse drug reaction which results in them having to discontinue the medication and/or try another one.

Thus, when selecting an SSRI to treat depressive symptoms, it is difficult to know how each individual patient will respond. Genetics can play a large role in depression outcomes. The relative impact of genes and environment on treatment response differs by drug class. For antidepressants, the impact of genetic factors is relatively strong. The diagnosis of major depressive disorder (MDD) encompasses a broad range of symptoms and symptom severity. Symptoms range from mild changes in motivation (reduced engagement in daily activities) to a marked reduction in enjoyment experienced from external stimuli (overt inability to get out of bed). Individuals diagnosed with major depressive disorder by their primary care physician typically report mild symptom severity. Some variability in outcome is simply related to the burden of disease. At presentation, symptom severity in MDD is known to be a strong predictor of effectiveness. Still, however, response to antidepressants is a complex trait with substantial contribution from a large number of common pharmacogene variants of small effect. The relative impact
of genetic factors in any given clinical trait can be measured within pedigrees and reported as "heritability" (H²).

For antidepressants, H² is approximately 0.4; i.e., in combination, genetic variants explain more than 40 percent of inter-individual differences in clinical response to antidepressant therapy. Overall, genetic test results may help us predict a patient’s response to antidepressant therapy. CYP enzymes metabolize most antidepressant medications, and the Clinical Pharmacogenetics Implementation Consortium (CPIC) publishes guidelines that show clinicians how to use this genetic information in routine practice. SSRIs are the most commonly prescribed class of antidepressants, and CYP2C19 is a key enzyme in the metabolism of many SSRIs. For three SSRIs known to be inactivated by CYP2C19 (sertraline, citalopram and escitalopram), poor metabolizers (PMs) are at increased risk of toxicity (including QT prolongation and ventricular arrhythmias). These patients should be monitored appropriately. For citalopram, the Food and Drug Administration (FDA) label warning currently states that 20 mg per day is the maximum recommended dose for CYP2C19 PMs (patients with two loss of function alleles; estimated to be 4 percent of the general population). Although guidance is less clear for patients with one loss of function allele, prescribers should be mindful of any concomitant medications with the potential to prolong the QT interval.

Another important principle is that the metabolism of antidepressants is robust (redundant). For example, many SSRIs are also oxidized by the cytochrome P450 2D6 (CYP2D6) enzyme, and CYP2D6 is "one of the most polymorphic of all human enzymes." For CYP2D6, about one out of every ten people (10 percent of the general population) inherits two nonfunctioning alleles. Thus, in addition to CYP2C19 test results, CYP2D6 test results can also help direct therapy with SSRIs. While CYP2C19 genotype impacts clinical outcome for citalopram, escitalopram and sertraline, CYP2D6 genotype impacts outcome for fluoxetine, fluvoxamine, and paroxetine. CPIC guidelines therefore recommend that patients with two nonfunctional CYP2C19 alleles avoid (or reduce dose for) citalopram, escitalopram and sertraline, while patients with two nonfunctional CYP2D6 alleles avoid (or closely monitor therapy on) fluoxetine, fluvoxamine, and paroxetine.

In summary, genetic data can guide SSRI dosing and potentially save patients from taking prolonged courses of medication without any benefit. Genetic data may also help some patients avoid SSRIs that could potentially cause them harm. It is inevitable that this information will be available routinely in the charts of many patients, and automated decision support prompts (Best Practice Advisories) are being built into electronic medical records to assist providers in prescribing SSRIs based on CYP2C19 and CYP2D6 genotype already. The convergence of clinical informatics and genomics is therefore changing the way we practice.

Lindsay J. Hines, PhD: More study is needed before genes can uniformly guide antidepressant therapy

The FDA currently requires genetic or genomic information in the labels of more than 150 prescription medications. However, at present, gene-based dosing is only considered standard of care for a small number of these medications. While guidelines are available to help clinicians use genetic information to dose some antidepressants (e.g., SSRIs), guidelines are not yet available for other antidepressants (e.g., SNRIs). Further, the available guidelines do not specify when patients should be genotyped. Restated, although CPIC does publish a dosing guideline that can be used for SSRI prescribing – “if genotype is available” – CPIC does not take a position as to when these CYP enzyme genotypes should be ordered.

Thus our knowledge is incomplete in many ways. Until guidelines clarify when to genotype, and until guidelines are uniformly available for all antidepressants, this approach seems premature. Other obstacles include failure of gene-based dosing models to include pharmacodynamic genes and/or additional relevant pharmacokinetic genes. As noted by Natasha Petry, PharmD, the metabolism of most antidepressants is redundant (involving multiple enzymes) and outcome for this class of drugs is influenced by variation in their mechanism of action. These issues are explored further below.

Issue #1. Which genotype(s)?

Pharmacodynamic (PD) genes influence a drug’s mechanism of action, whereas pharmacokinetic (PK) genes influence the level of a drug or drug metabolite in the blood or within a specific organ like the brain. Thus, PK gene variants may alter a drug’s absorption, distribution, metabolism, or elimination. As noted by Dr. Petry, several successes in the field of neuropsychiatric pharmacogenetics have been realized within the context of PK genes, particularly genes encoding the CYP genes. However, PK genes only account for a small fraction of the overall variability in
clinical response to psychotropic agents like the antidepressants. The addition of PD gene variants will likely improve our ability to predict outcome, but CPIC guidelines are not yet available for the use of these PD gene variants in the context of antidepressant therapy. Some authors have therefore advocated for using comprehensive gene panels including PD genes like the serotonin transporter gene. However, the output from these panels is often based on proprietary decision support rules, and their clinical advice is printed as a PDF rather than being linked to automated decision support in an electronic medical record.

While simple CYP genotypes (CYP2C19 and CYP2D6) are now being utilized as discrete data linked to best practice advisories based on CPIC guidelines at some institutions, guidelines have only been published for the SSRIs, not the SNRIs or other psychotropics. While promising, this approach needs to be expanded – to all PD and PK genes impacting all classes of antidepressants – and it needs to be standardized across multiple institutions before it will be widely beneficial.

Issue #2. Which phenotype(s)?

Neuropsychiatric phenotypes are historically difficult to define and measure. For neurocognitive endpoints, imaging only loosely correlates with function. Rigorous functional data (neuropsychological testing) are rarely available to guide therapy, and treatment response is measured by clinical judgment in the context of routine care, leaving only limited data available to phenotype outcome for depression within electronic medical records. This makes it very difficult to quantify the impact of pharmacogene variants on outcome in observational cohorts.

Objective endpoints are needed. In a previous article in this series, Drs. Wilke and Fanciullo described the advantages of using lab data (CK) as a marker for statin intolerance. For statin-induced myopathy, the availability of a trait that can be objectively quantified led to the identification of PK gene variant with a huge impact on drug intolerance (i.e., odds ratio approaching 20.0). There are few objectively measurable quantitative traits for depression within the context of routine clinical care. While patient response to antidepressant therapy is sometimes measured by the Patient Health Questionnaire-9 (PHQ-9), the PHQ-9 is only a small part of the necessary assessment. Novel strategies are needed, beyond simple survey instruments, to identify genes contributing to outcome in patients being observed for symptom improvement and behavior changes on SSRIs.

Issue #3. Which approach?

Should we use genotype to select which drug, or should we use genotype to select which dose? Both approaches have been presented in earlier articles in this series. Drs. Larson and Miller discuss the utility of CYP2C19 genotype to select the drug, for patients requiring antiplatelet therapy. Drs. Lu and Miller discuss the utility of genotyping both CYP2C9 and VKORC1 (a PD gene) to guide initial dosing for warfarin-naive patients during their first week of anticoagulation. For the SSRIs, the best approach remains unclear.

The answer to this question needs to be standardized before gene-based prescribing can be applied to a drug class as large and complex as the antidepressants. Perhaps the solution might be to use one approach (adjust the dose) in primary care and to use the second approach (switch the medication) in the context of specialty care. While approaches such as these hold the potential to help patients avoid (or reduce) two- to six-month periods of trial and error prescribing, the effectiveness of these approaches – and their impact on cost and adherence – remain largely unquantified.

The field of neuropsychiatric pharmacogenetics is still in its early days. Until these questions are answered, genetic testing may not be the optimal approach to guiding antidepressant therapy.

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Please note: Due to limited space, we are unable to list all references. You may contact South Dakota Medicine at 605.336.1965 for a complete listing.

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Together we can give South Dakotans the support and tools they need to quit using tobacco.
Overview

Glomeruloid hemangioma (GH) is an extremely rare variant of capillary hemangioma. The lesions are often located in the dermis, but can occur in extracutaneous locations. Histologically, these are complex intravascular proliferations that resemble normal renal glomeruli. Originally they were considered to be pathognomonic to POEMS (Polyneuropathy, Organomegaly, Endocrinopathy, Monoclonal gammopathy and Skin changes) syndrome. But subsequent reports indicate that GH can occur in patients without POEMS. We herein present two cases of GH in otherwise normal individuals and review of the literature.

Case Report

Case one is a 34-year-old male who presented to dermatology clinic with a non-tender slowly growing nodular lesion on his scalp present for one year. Clinically, it was a 15 mm smooth nodule which was thought to be a vascular tumor versus neurofibroma. He had similar lesion on the right side of his nose as well. A biopsy of the scalp lesion was performed. Our second case is a 57-year-old male who presented with a 7 mm raised lesion on his back that was present for several years and had become itchy and tender recently. He also noticed 2 and 3 mm red asymptomatic papules on his chest six months ago. Biopsies of chest and back lesions were performed. Both of our patients were otherwise healthy with no other medical conditions. Histological examination of the specimens revealed dermal capillary-sized vascular proliferation within ectatic vascular spaces. The stroma contained pink periodic acid-schiff (PAS), positive hyaline globules in between the capillary loops. Significant atypia or abnormal mitoses were absent. The lesion was extending into subcutaneous tissue in our first case. Based on typical histology, these were diagnosed as glomeruloid hemangiomas in both cases. Our patients remained asymptomatic, and did not develop new lesions or had any evidence of POEMS syndrome during the follow-up of 39 and 14 months, respectively.

Discussion

Glomeruloid hemangiomas are benign vascular tumors, first introduced by Chan et al. in 1990 in couple of his POEMS patients. Over several years, other authors have
noticed similar lesions in patients with Sjögren’s syndrome, Von Hippel-Lindau syndrome, idiopathic thrombocytopenic purpura, and also in patients who are otherwise healthy.\textsuperscript{1-5} Comprehensive review of literature, including our own two cases, has shown a total of 15 reported cases of GH in patients without POEMS syndrome.\textsuperscript{5,7} Solitary or multiple GH lesions are seen in non-POEMS. Average age of presentation is 50 years with male predominance; whereas POEMS-associated GH is often seen in females and presents as multiple lesions. Classic cases present as red papulonodular lesions of few millimeters on trunk and extremities, often in Japanese population. Microscopically, they are well-circumscribed, unencapsulated lesions of coiled capillary-sized blood vessel proliferation reminiscent of renal glomeruli. The lining endothelial cells are mildly enlarged and interspersed plump “stromal” cells may contain clear vacuoles and PAS-positive and immunoglobulin positive eosinophilic hyaline globules and represent enlarged secondary lysosomes on electron microscopy.\textsuperscript{8} The endothelial cells express factor VIII-related antigen, CD31 and CD34. Pathogenesis of the endothelial proliferation in these lesions is considered to be secondary to overproduction of vascular endothelial growth factor receptor-1.\textsuperscript{5}

### Conclusion

Glomeruloid hemangiomas are benign intravascular capillary-type hemangiomas which can occur in both cutaneous and extracutaneous sites. They may represent part of spectrum of lesions in POEMS syndrome or can occur in otherwise normal individuals. In POEMS syndrome the GH occur as multiple lesions with a female predilection, whereas in non-POEMS cases GH present as solitary or multiple lesions and show slight male predilection.

### References

Please note: Due to limited space, we are unable to list all references. You may contact South Dakota Medicine at 605.336.1965 for a complete listing.

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Epidemiologic Study of Bacteria Zoonotic Diseases in South Dakota: 2010-2014

By Jessica L. Ludvik, DVM, MPH; Susan M. Anderson, MD; and Mark K. Huntington, MD, PhD

Abstract

Background: Although the burden of infectious diseases has decreased dramatically due to advances in health care, disease prevention and numerous public health efforts and innovations, zoonotic diseases continue to pose a problem in terms of both existing and emerging diseases. These risks are of particular concern in rural areas, in which there is more contact with animals for occupational and recreational purposes. As a rural and agricultural state, South Dakota has a large percentage of its population at risk of exposure to zoonotic diseases through their substantial contact time with animals.

Methods: De-identified data from the South Dakota Department of Health containing the variables and diseases of interest from the time period of 2010-2014 was obtained. From this data were calculated the incidence rates by county, and seasonal and demographic patterns of the diseases were plotted.

Results: The incidence of disease in South Dakota were higher than the national rates for campylobacteriosis (threefold), cryptosporidiosis (sixfold), enterohemorrhagic E. coli (fourfold), Q fever (tenfold), salmonellosis (1.2-fold), and tularemia (14-fold). Only listeriosis had a lower incidence than the national rate among zoonoses included in this study. Seasonality of campylobacteriosis in the state was earlier in the year than is reported for the disease nationally.

Conclusion: Zoonotic infections are a substantial threat to health in South Dakota. There is a need to develop collaboration between healthcare providers, public health professionals, livestock producers, veterinarians, and sportsmen to develop a strategy to address this issue.

Introduction

The state of South Dakota possesses many unique demographic characteristics which render its population highly susceptible to increased rates of zoonotic disease infection. Much of this increased risk stems from the rural nature of its population, economy, and recreation. In areas where contact with animals is an essential part of daily work and life, the amount of contact time and potential lapse in hygiene due to familiarity with animal contact further increases the likelihood of contracting a zoonotic infection.

In 2000, South Dakota had a higher percentage of its population classified as “rural-farm” residents (7.7 percent) than any of the surrounding Midwestern states (Iowa, Minnesota, Montana, Nebraska, North Dakota, and Wyoming). It also had a very high percentage of rural-nonfarm residents (40.4 percent). In addition, 8.1 percent of the state’s population is employed in agriculture. This does not take into account the millions of tourists that the state attracts yearly to its outdoor attractions such as hunting, fishing, national monuments, and state parks. All of these offer opportunities for contact with wildlife, farm animals, and disease fomites and vectors, thus increasing chances of zoonotic infection. Another demographic characteristic of South Dakota that may influence zoonotic disease incidence is the large population of American Indians. Comprising approximately 8.3 percent of the state’s population, certain lifestyle factors and traditions may put this group at increased risk of
developing specific zoonoses. Another subpopulation at potentially increased risk is hired farm laborers and immigrant workers. These also pose a challenge in disease monitoring, as they may fail to seek health care due to the proximity of providers, lack of health insurance, and fear of authorities because of the potential for deportation.

As with any disease-causing organism, understanding the biology and nature of the organism is critical to identifying routes and associating these routes with risks for transmission of zoonotic infections. The majority of zoonotic organisms have many possible routes of transmission in addition to direct contact with animals, such as ingestion of contaminated food or water, contact with fomites, aerosolization, mechanical or biological vectors, etc. This makes monitoring and quantification of the disease burden of zoonoses challenging, as identifying a definitive source of infection in any given case may be extremely difficult.

The objective of the work reported herein was to perform a descriptive epidemiologic analysis of the most common bacterial zoonotic diseases in South Dakota to quantify the disease burden of these conditions throughout various geographic areas, age groups, and times of year. The goal was to identify areas of greatest need in the state to aid in planning educational programs and disease interventions.

**Methods**

Following a review of publicly available published South Dakota Department of Health summaries, a list of reportable zoonotic diseases of interest was compiled. With the assistance and approval of the South Dakota state epidemiologist, a de-identified data set containing the variables and diseases of interest from the time period of 2010-2014 was obtained. From this data were calculated the incidence rates by county, and seasonal and demographic patterns of the diseases were plotted. No quantitative analysis was performed; the current study was limited to descriptive statistics.

**Results**

Seven specific zoonotic conditions were identified as of potential significance to the population of the state. These include campylobacteriosis, cryptosporidiosis, enterohemorrhagic *Escherichia coli*, listeriosis, Q fever, salmonellosis, and tularemia.

**Campylobacteriosis**

From 2010-2014, a total of 1,476 cases of campylobacteriosis were diagnosed in South Dakota. Sixty-four percent of these were identified as *C. jejuni*, with *C. coli*, *C. gracilis*, and *C. ureolyticus* also found. Thirty-four percent of isolates were not speciated beyond the genus level. Incidence of infection in the state during the time period surveyed was three times the national incidence in 2012. A summary of cases and incidence is presented in Table 1. Cases occurred predominantly in early to mid-summer (Figure 1A). There was a slight male predominance (65 percent), with 47 percent of those affected between ages 25-64 years. Distribution of infections based upon ethnic identity is shown in Table 2.

**Cryptosporidiosis**

Table 1 shows the incidence rates by county. The highest rates were observed in Charles Mix and Yankton counties, both with over 100 reported cases per 100,000 people. Peak incidence is seen in summer months. The age distribution reveals the majority of cases being in children 1-14 and adults 24-39 (Figure 2). Table 2 shows the ethnic distribution of infection.

**Enterohemorrhagic (shiga toxin-producing) Escherichia coli (EHEC)**

The incidence rates by county are displayed in Table 1. Cases were most common in the summer and fall (Figure 1). A large number of cases occurred in young children (Figure 2); the distribution of cases by ethnic identity is shown in Table 2.

**Listeriosis**

There were only four reported cases of listeriosis over the five-year time frame of this study, all occurring between June and September. Geographic location of the cases is shown in Table 1.

**Q Fever**

As with listeriosis, few cases of this disease were reported during the study period as shown in Table 1. Cases occurred throughout the calendar year without an apparent seasonality. All cases occurred in patients aged 25 years and older.

**Salmonellosis**

Case numbers and incidence, by county, are shown in Table 1. The most common species of *Salmonella* reported in the state from 2010-2014 were *S. typhimurium* (298 cases, representing 39 percent of all cases) and *S. enteridities* (142 cases, 18.7 percent of cases). An additional 66 species were also reported in significantly lower numbers. The majority of South Dakota cases occurred in adults aged 40-64 years (Figure 2). There was a slight seasonal
Table 1. Number of Cases and Incidence Rates of Select Zoonotic Infections by County: 2010-2014

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<tr>
<th>County</th>
<th>Campylobacter Cases</th>
<th>Cryptosporidiosis Cases</th>
<th>EHEC Cases</th>
<th>Listeriosis Cases</th>
<th>Q Fever Incidence</th>
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*Incidence rate is expressed as cases per 100,000 per year.*
variation in cases favoring the summer, with the exception of 2010 during which an outbreak of 28 cases in Brown County caused an overall peak in November (Figure 1).

**Tularemia**

For the reporting period of 2010-2014, there were 35 cases of tularemia. The county with the highest number of cases was Shannon County (nine), while that with the highest incidence was Buffalo County (31.4 per 100,000) (Table 1). During the last five years, all documented cases have been observed throughout the warm and temperate seasons, with peak incidence occurring in June. Approximately 83 percent of cases occurred in children between the ages of 1 and 15. Fifty-seven percent of the cases were in females and the majority of affected individuals reported their race as American Indian (Table 2).

**Discussion**

There are many challenges inherent in the monitoring of any disease. Included in these are the identification and reporting of cases. The different degrees of severity of symptoms may lead to lack of recognition and reporting, especially in rural areas where access to health care providers may be limited. Infections may be mild and disregarded, or completely asymptomatic. For example, it is estimated that 60 percent of Q fever cases are asymptomatic and only 2 percent of cryptosporidiosis cases are reported. Thus, the numbers available for analysis are an extreme underrepresentation of the true number of infections occurring annually. Another aspect contributing to the lack of case identification is a lack of accurate diagnosis by health care providers. Animal contact may often be
overlooked as a very important risk factor in acquiring a disease, leading to zoonotic diseases being buried in a list of possible diagnoses. Adding to the challenge of monitoring is the risk of infection in hired farm laborers and immigrant workers, who may not seek health care due to the proximity of health care, lack of health insurance, or concerns about possible detention and deportation. The absence of any zoonotic infections identified in individuals of Hispanic background, despite their composition of 3.4 percent of the general population (Table 2), may be an illustration of that fact.

**Campylobacteriosis**

*Campylobacter* spp. are fairly ubiquitous intestinal flora in mammals, and thus there are many potential sources of human infection. The most pathogenic species to humans are *C. jejuni*, *C. coli*, and *C. fetus*. It may be acquired via ingestion of foods that were contaminated during the slaughter, processing, packaging, or preparation process. Consumption of unpasteurized milk also poses a considerable threat of contracting the disease. The organism may also be present in water that is inadequately sanitized. Although many animal species are subclinical carriers, *Campylobacter* infection frequently manifests itself as diarrhea and abortion in domesticated animals. The potential for zoonotic transmission is increased when children are in contact with a diarrheic juvenile dog or cat. It may also be contracted via direct contact with the feces, vaginal secretions, and aborted fetuses of sheep, goats, and cattle.6,7

While campylobacteriosis generally exhibits seasonality in both poultry and humans, with peak incidence occurring in late summer and early fall,2 in South Dakota most cases occur in early to mid-summer (Figure 1A). Nationally, infection is most common in young children and young adults; in our state nearly half of cases over the last 5 years were from the ages of 25-64 years. The reason for this difference between local and national epidemiology is not clear.

**Cryptosporidiosis**

*Cryptosporidium parvum* oocysts are shed in large numbers in the feces of infected humans and animals. Transmission is usually fecal-oral through ingestion of contaminated food or water, but aerosolization can also occur. The oocysts are immediately infectious and ingestion of as few as 10 oocysts can cause disease. The organism is capable of infecting all mammals, but is most commonly seen in young ruminants and pigs. Clinical signs range from asymptomatic to severe diarrhea, anorexia, tenesmus, and weight loss.5,8

The national incidence rates of reported cases of cryptosporidiosis in 2011 and 2012 were three and 2.6 cases per 100,000 people, respectively, with the highest rates reported in the Midwest. South Dakota topped the charts with 17.7 cases per 100,000 in 2011, and came in second in 2012 with 13.6 cases per 100,000.9 This is consistent with our findings (Table 1). Timing of cases in South Dakota is also consistent with the trend seen nationally (Figure 1B), thought to coincide with the increase in recreational water activities.

**Listeriosis**

*L. monocytogenes* is ubiquitous in soil and the intestinal tracts of asymptomatic animals. Most human cases result from ingestion of the organism in unpasteurized or uncooked foods, especially cheeses, deli meats, and ice cream. Humans may also become infected via direct contact with animals, especially during calving, lambing,
and necropsies. Most human cases are associated with ruminants; however, many other animals, including birds, rabbits, pigs, dogs, and cats can be infected with the organism. In animals, there are three forms of the disease: encephalitis, abortion, and septicemia. The encephalitic form is characterized by often unilateral neurologic signs accompanied by depression and anorexia. Abortion usually occurs in the last trimester with infection of pregnant animals. Septicemia is most often seen in neonates. It is rare to see more than one form of the disease in the same flock or herd at the same time.

The four reported cases of listeriosis in South Dakota over the five-year time frame of the present study represents an incidence rate of less than 0.1 cases per 100,000 population. This is lower than the national incidence rate for 2009-2011, which was 0.3 cases per 100,000. National data from these three years also show the highest incidence rate in individuals over 65 years of age. Of total reported cases, 14 percent were pregnancy-associated, and of these, 43 percent were in Hispanic women. Of the national cases that were not pregnancy-associated, 74 percent had an underlying medical condition. The reasons for the difference between the local and national epidemiology are unclear and present an area for future investigation.

Q Fever
Coxiella burnetii is highly contagious and may cause infection by aerosol, direct contact, or ingestion. Ticks and other parasitic insects may serve as mechanical vectors to spread the disease among wildlife. Ruminants, wild rodents, and cats are most commonly implicated in human infection; however, many other species can carry the disease. In animals, the predominant clinical signs in animals are reproductive disturbances: infertility, endometritis, near term abortion, stillbirth or weak offspring, and retained placenta. Some species may lose their appetite and become depressed, and cats may also have a fever and upper respiratory signs. Large numbers of C. burnetii are shed in the placenta and aborted fetuses, fetal fluids, milk, urine, and feces.

The average national incidence rate of reported human cases of Q fever in the U.S. is 0.3 cases per 1 million people, with incidence rates highest in Midwestern states. In 1998-2010, peak incidence was found to occur from April to June, corresponding to lambing, kidding, and calving. From 1998-2010, the highest number of cases were observed in adults age 40 and above. There were not enough cases reported in South Dakota during the time period analyzed for this report to observe a definitive trend in seasonality of the disease in the state, though the age distribution was similar.

Salmonellosis
Many different species and serovars of Salmonella are responsible for this disease. It most often is associated with enteritis and septicemia, with a specific serotype usually causing a specific syndrome; however there can be some variation. Salmonella can be shed by both symptomatic and asymptomatic humans and animals. The primary mode of transmission is fecal-oral through contamination of food and water, but fomites and mechanical vectors such as insects can also spread the organism. Salmonella species have been found in all animal species that have been studied; however, most human infections result from handling feces of reptiles, chicks, and ducklings. Livestock and horses are other common sources of infection. Similar to humans, asymptomatic, gastrointestinal, or septicemic salmonellosis may be observed in animals. Apparently healthy animals may begin to shed Salmonella when they are stressed. Reptiles rarely show clinical signs, but may shed the organism persistently or intermittently, and thus it is advised that immunocompromised people avoid contact with them. Acute, subacute, and chronic enteritis is the most common form of disease in older animals. Clinical signs include profuse diarrhea, dehydration, depression, abdominal pain, anorexia, and fever. The septicemic form is most often seen in very young animals. Infection of pregnant animals may result in abortion, with or without other signs.

In 2010, Salmonella was the most commonly reported infection in the U.S. with an incidence rate of 17.6 cases per 100,000 people. The incidence rate for South Dakota over the last five years was slightly higher than that at 21.3 cases per 100,000 persons. Nationally, the number of salmonellosis cases peaks through the months of July through September; this was not seen as distinctly in the South Dakota data, though there was a general tendency to rise in the warmer months (Figure 1C). The age group with the highest reported incidence rate was children 0-4 years of age. Though there were a large number of cases in young children, most cases were observed in adults aged 40-64 in South Dakota (Figure 2C).

EHEC
Pathogenic species of E. coli differ in their virulence based on the type of toxins they produce. The primary reservoirs for E. coli O157:H7 are ruminants. Other
animals may shed the organism, but it is unknown if they are reservoirs or just temporary carriers. E. coli O157:H7 is not often associated with disease in animals, however, has experimentally produced diarrheal illness with some deaths in animals less than one week of age. Other strains of EHEC may cause disease in various species of animals. Humans usually acquire infection via fecal-oral route through ingestion of contaminated food or water, or contact with animals, soil, or other mechanical vectors. It is estimated that it only takes from 10-100 organisms to cause infection. Humans do not usually carry EHEC, but may shed it for three weeks or longer after infection. 17

The national incidence rate reported for E. coli O157:H7 in the U.S. in 2012 was 1.1 cases per 100,000 people.18

The incidence rate for South Dakota from 2010-2014 was much higher, at 5.1 cases per 100,000. Similar to national trends, cases in the state are most common in the summer and fall (Figure 1D). This may correspond to seasonality in shedding by animals, or may be because of an increase in contaminated food eaten during summer activities.17

Also similar to national data, there was noted a predilection for children (Figure 2D) and “white” ethnicity (Table 2). 19

**Tularemia**

Tularemia occurs in temperate regions worldwide. It has been reported in all states of the U.S. except Hawaii. Since the 1950s, the number of cases in the country has been declining; however, from 1990 to 2000, South Dakota still accounted for 7 percent of national cases.20

A potentially fatal zoonosis caused by the bacteria Francisella tularensis, this disease is highly infectious, with as few as 10 organisms capable of causing disease. Many different species of animals may be infected, and arthropods, especially ticks, serve as maintenance hosts and vectors. In the U.S., epizootics of the disease are most common in rodents and lagomorphs (hares and rabbits). Dogs and cats may become infected with the disease, with clinical signs being more commonly recognized in cats. Livestock are also susceptible, with most incidences being reported in sheep, but cases in horses and cattle have also been observed. Illness in animals may range from subclinical to severe, and includes clinical signs such as fever, lymphadenopathy, abscesses, mucocutaneous ulceration, and upper respiratory discharge. The most common means of transmission in the U.S. are via arthropod bite and direct contact with an infected animal.20

Historically, there have been two peaks in tularemia case incidence, corresponding to the route of transmission. One May-August resulting from infection by arthropod bites, and one in the winter resulting from direct contact with infected animals during rabbit hunting. During the last five years, all documented cases in South Dakota have been observed throughout the warm and temperate seasons, with peak incidence occurring in June, corresponding with the ideal time for arthropod transmission.

Nationally, the highest incidence in cases is in individuals 5-9 years of age and greater than 75 years of age. In South Dakota, approximately 83 percent of cases occurred in children between the ages of 1 and 15 years, and overwhelmingly disproportionately affected individuals who identified their race as American Indians (nearly 66 percent of cases, despite representing less than 9 percent of the total population).

**Limitations**

The low population in the state of South Dakota yields a small denominator for the calculation of incidence rates. While large disparities between the national incidence rates and that of the state are likely real, smaller differences may not reflect statistically meaningful difference. In addition, the low number of cases of each condition could be affected by mis-, over-, or under-diagnosis biases, significantly affecting the numerators. These considerations must be borne in mind when interpreting our findings.

This paper is not a comprehensive report on all of zoonotic diseases. Other bacterial zoonoses of potential concern in South Dakota include anthrax, plague, and tuberculosis. There have been no reported cases of anthrax or plague over the past five years. Zoonotic (bovine, avian) tuberculosis is rare in the state; the Department of Health compiles a detailed annual tuberculosis report, which can be accessed online.21 Of course, viral zoonotic diseases such as hantavirus, rabies, and West Nile virus are outside the scope of this paper.

**Future Directions**

This descriptive study includes baseline data for the aforementioned diseases and could be expanded. For example, a review of more detailed case histories for the cases summarized herein could be undertaken. This would allow for a more comprehensive analysis of occupational and personal risk factors. The data could also be used to calculate additional epidemiologic parameters, such as risk ratios, case fatality rates, and incidence rates by race, age,
gender, and occupation. It may also be helpful to observe for seasonality of diseases in different age groups. Data and trends found to be relevant to interventions could be compiled to generate a number of metrics to be used to benchmark the success of the implemented health interventions. Naturally, in order to obtain adequate numbers for some of these measures, it may be necessary to expand the inclusion time frame beyond five years for these future analyses.

It is our hope that the current study will stimulate increased communications among health care providers, public health educators, livestock producers, veterinarians, and sportsmen. There is a need for a collaborative effort to decrease the disease burden of zoonoses on South Dakotans. One potential avenue by which such a collaboration might occur is the South Dakota One Health working group (www.onehealthsd.org) which draws participants from most of these groups. A multidisciplinary approach

### Box 1. Clinical Presentations of Zoonoses Discussed in this Paper

**Campylobacteriosis**
*Campylobacteriosis* in humans is characterized by a headache, fever, and muscle aches progressing to abdominal cramps, diarrhea, and worsening fever. It can be fatal, particularly in infants, the elderly, and the immunocompromised. Potential sequelae of the disease are Guillain-Barre syndrome and reactive arthritis.

**Cryptosporidiosis**
*Cryptosporidiosis* is a diarrheal disease which is most commonly self-limiting, unless the host is immunocompromised. In addition to profuse watery diarrhea, other symptoms are abdominal cramps, vomiting, weight loss, fever, and myalgia. Pulmonary and tracheal cryptosporidiosis may accompany intestinal signs in immunocompromised patients. The incubation period for the disease is one to 12 days.

**Listeriosis**
Caused by *Listeria monocytogenes*, the disease is usually self-limiting in healthy people and consists of diarrhea, fever, nausea, abdominal pain, and myalgia. It is of considerably more significance to immunocompromised groups. In pregnant women, it can lead to abortion, premature delivery, or septicemia of the newborn. Septicemia in neonates can lead to disseminated granulomatosis, respiratory disease, or meningitis. In elderly and immunocompromised individuals, possible complications include meningitis, brain abscesses, endocarditis, septic arthritis, osteomyelitis, and pneumonia.

**Q Fever**
*Coxiella burnetii* can produce acute or chronic infection in humans. Acute disease consists of a flu-like illness with fever, headache, fatigue, myalgia, sore throat, and chest pain. This is usually self-limiting, but can be accompanied by atypical pneumonia or hepatitis. Other rare complications are inflammation of the heart, brain, bone marrow, and other organs. The most common manifestation of chronic Q fever is endocarditis, but lesions in the blood vessels, spine, bones, liver, lung, and kidneys have also been reported. In pregnant women, infection may cause placentalitis, abortion, premature birth, and low birth weights.

**Salmonellosis**
Gastroenteritis caused by *Salmonella* is usually self-limiting unless the host is immunocompromised. It is associated with nausea, vomiting, abdominal cramps, and diarrhea which is sometimes bloody. Salmonellosis in the elderly and immunocompromised may result in septicemia and subsequent meningitis and/or death. Enteric fevers are another form of severe disease in which a flu-like achiness and fever may follow gastrointestinal signs. Other possible complications are septic arthritis, abscesses, endocarditis, pneumonia, and Reiter’s syndrome.

**Shiga-toxin Producing E. coli**
Some *E. coli* produce verotoxin, which is similar to the shiga toxin produced by *Shigella dysenteriae*. Enterohemorrhagic *E. coli* (EHEC) produce these toxins, plus additional factors which enable them to cause hemorrhagic colitis and hemolytic uremic syndrome (HUS). *E. coli* O157:H7 is one of the EHEC strains most commonly associated with HUS. Symptoms include profuse watery or bloody diarrhea, nausea, vomiting, and fever. It may progress to intestinal perforation or strictures. HUS may develop in 10-16 percent of patients with hemorrhagic colitis, most commonly the very young, very old, or immunocompromised. Symptoms of HUS are hemolytic anemia, thrombocytopenia, and kidney failure. Another form of HUS known as thrombotic thrombocytopenic purpura is seen most commonly in the elderly. There is less kidney involvement than HUS, but may be more neurologic signs.

**Tularemia**
Infection by *Francisella tularensis* often manifests as an acute febrile and flu-like illness with an incubation of three to five days. There are six clinical syndromes, which depend on the route of inoculation. They are: ulceroglandular, glandular, oropharyngeal, oculoglandular, pneumonic, and typhoidal. All have the possibility of progressing to pleuropneumonia, meningitis, sepsis, and death.
has the potential to advance education in prevention, early diagnosis, and proper treatment of these conditions. In so doing, the public health threat of zoonotic infections in our state could be decreased. The impact of such a movement has the potential to impact not only the state, but the region, as many of our agricultural operations and ideals extend beyond our state lines.

Conclusions

We have compiled a baseline, descriptive epidemiologic study of some of the more common zoonotic diseases in South Dakota, identifying time, geographic, and demographic trends in these diseases in order to identify specific risk factors for the disease-causing organisms. A multidisciplinary approach to the control of these diseases, which are more prevalent in South Dakota than nationally, is needed.

Acknowledgement: The authors wish to thank the South Dakota state epidemiologist, Lon Kightlinger, MSPH, PhD, for his keen insights and wise counsel, and for generously sharing the de-identified disease data necessary for our analysis.

REFERENCES


Please note: Due to limited space, we are unable to list all references. You may contact South Dakota Medicine at 605.336.1965 for a complete listing.

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The Impact of a Rural Training Track on Medical Students Specialty Choice

By Brooke Jensen, MS IV; Susan M. Anderson, MD; and Edward Simanton, PhD

Abstract

Background and objectives: Compare the expectations and outcomes of students involved in rural medical training versus those of urban trainees.

Methods: Survey items relating to primary care interest were added to program evaluation surveys already being sent at the beginning and end of the primary clinical year. Students from the graduating class of 2016 and the class of 2017 responded to the surveys (N=115). Responses from students trained in rural sites were compared with students trained in medium or large communities. For the purposes of the survey, primary care was not specifically defined and was open to participants’ interpretation. Primary care is commonly thought of as the medical care from the doctor who sees a patient first and provides treatment or decides the other specialist care that the patient may need. Primary care specialties can include family medicine, internal medicine, pediatrics and obstetrics and gynecology.

Results: Most students enter their primary clinical year undecided about specialty choice and preferred practice location. At the end of the primary clinical year, most students have decided on a specialty and most report wanting to practice in communities similar to where they trained during that year. Before the primary clinical year student attitudes toward primary care are not significantly different based on selected training site. However at the end of the primary clinical year, students who had been trained in small communities were significantly more likely to choose primary care compared with students trained in medium to large communities.

Conclusions: For students who begin the primary clinical year undecided regarding specialty choice, and practice location, the community size of the training site plays a large role in the decisions they will make. A majority of students trained in small communities chose to go into primary care and practice in small communities.

Despite an increase in the number of physicians produced in the U.S., a persistent geographic maldistribution of physicians has continued. While 20 percent of the U.S. population lives in rural areas, only 9 percent of physicians do. Many educators believe there is an opportunity for medical education to recapture the diversity and relevance of distributed training that is uniquely adapted and responsive to the needs of rural underserved communities and has the potential to reclaim medicine’s social contract with the public.

South Dakota, being a rural state, where beef cattle outnumber humans five to one, faces challenges in health care access for its citizens living in rural and frontier communities. South Dakota has an aging population and aging primary care physicians, thereby setting the stage for severe health care shortages. To address this issue, the University of South Dakota Sanford School of Medicine (USD SSOM) developed the Frontier And Rural Medicine Program (FARM). This program places selected third-year medical students into rural communities for nine months of their training.

The FARM program was created and directed by the Family Medicine Department of the USD SSOM. Site selection was based upon the ability to provide meaningful and comparable clinical experiences in each of the major disciplines of family medicine, internal medicine,
pediatrics, neurology, OB/GYN, psychiatry and surgery, with a family physician or internal medicine physician serving as the site physician coordinator.

As initiatives are created to face the rural health care crisis, it is worthy to note that rural physicians continue to demonstrate a satisfaction with practice and a passion for service.4 FARM students receive hands on education and gain an understanding of the rewards and challenges of rural practice. Students assist in community health education and implement a community project to benefit their community site.

Learning in context is essential to training for rural practice. There is no substitute for personal experience in rural medicine. The rural physician’s scope of practice cannot be rigidly defined and is best defined by the needs of the community. The American Academy of Family Physicians and the National Rural Health Association have recommended that cumulative rural training experience for all medical students and residents with an interest in rural medicine should be at least six months in duration.5

Since its inception in 2014, the FARM program has accepted 28 students and 11 students have completed the program in five sites. Five students out of 63 in the class of 2016 and six students out of 57 in the class of 2017 have completed the program. This is in line with expectations of approximately 10 percent of the total class.

Towards the goal of providing a sustainable rural health provider work force, one of the former FARM students from the graduating class of 2016 is in negotiations with his FARM site to return after completing residency. Four out of the first group of five FARM students from the class of 2016 have matched to family medicine residency programs, with hopes of practicing in a rural community. The balance of the class completes their clinical education on one of three of the medical school’s campuses: Sioux Falls, Rapid City or Yankton. For the purposes of this study, these larger campuses are referred to as urban whereas the FARM sites are rural.

### Purpose of the Study

This study compares the expectations and outcomes of students involved in rural medical training versus those of urban trainees.

### Methods

Survey items relating to primary care interest were added to program evaluation surveys already being sent at the beginning and end of the primary clinical year. Students from the class of 2016 and the class of 2017 responded to the surveys (N=115). Responses from students trained in rural sites were compared with students trained in medium or large communities. For the purposes of the survey, primary care was not specifically defined and was open to participants’ interpretation. This study was authorized by the Institutional Review Board of the University of South Dakota (Approval #2011.143).

### Results

Response numbers and response rates are shown in Table 1. Although relatively few students were trained in small communities, all students trained in those communities responded to both surveys. Overall response rate on the pre-clinical year survey was 77.4 percent. All students completed the post-clinical year survey.

Future plans of trainees before the start of the primary clinical year are shown in Table 2. As would be expected at this point in training, the majority of students were undecided regarding specialty choice or location of future practice. Chi-squared tests indicate that differences between students regarding primary care plans were not significant between groups ($\chi^2(4, N = 89) = 2.054, P = 0.726$). While none of the students who selected to be trained in small communities had ruled out rural practice in their future, 38.3 percent of the students who selected training in medium or large communities disagreed or strongly disagreed that they plan to practice in a rural community. This difference in future practice location was significant ($s^2(4, N = 89) = 17.068, P = 0.002$).

### Table 1. Survey Response Numbers and Response Rates

<table>
<thead>
<tr>
<th>Training Location</th>
<th>Pre-Clinical Year Surveys</th>
<th>Response Rate</th>
<th>Post-Clinical Year Surveys</th>
<th>Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Communities (Pop. &lt;5000)</td>
<td>11/11</td>
<td>100.0%</td>
<td>11/11</td>
<td>100%</td>
</tr>
<tr>
<td>Medium – Large Communities (Pop. 15,000-170,000)</td>
<td>78/104</td>
<td>75.0%</td>
<td>104/104</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>89/115</td>
<td>77.4%</td>
<td>115/115</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Table 2. Future Plans of Trainees Before Primary Clinical Year

<table>
<thead>
<tr>
<th>Future Plans</th>
<th>Group</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not decided yet</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan to go into primary care</td>
<td>Rural Communities (Pop. &lt;5000)</td>
<td>10 (2)</td>
<td>8 (0)</td>
<td>5 (0)</td>
<td>0 (0)</td>
<td>18 (0)</td>
<td>59 (0)</td>
</tr>
<tr>
<td>Plan to practice in rural area</td>
<td>Rural Communities (Pop. 15,000-170,000)</td>
<td>10 (0)</td>
<td>8 (0)</td>
<td>54 (6)</td>
<td>55 (0)</td>
<td>27 (3)</td>
<td>18.2%</td>
</tr>
</tbody>
</table>
Future plans at the end of the primary clinical year are shown in Table 3 comparing rural and urban trainees. Students trained in smaller communities with plans to go into primary care were significantly stronger than those trained in medium to large communities ($x^2(4, N = 89) = 12.198, P = .016$). All students trained in small communities and most students trained in other sized communities agreed that they would someday like to practice in that community or similar community.

Changes that occurred during the primary clinical year are shown in Table 4. These changes are determined by examining the decisions of students who were undecided in the pre-clinical year survey. In the question regarding plans to practice in rural areas, all of the rural trainees who were undecided, are now planning to practice in rural areas. In the question regarding plans to go into primary care, among rural trainees, most (72.7 percent) decided to go into primary care. One (16.7 percent of the undecided) rural trainees decided not to go into primary care and one other (16.7 percent) remained undecided. Among the urban trainees who were undecided regarding going into primary care, half remained undecided, 6.7 percent decided to go into primary care and 43.3 percent decided not to go into primary care.

Conclusions
Most students enter their primary clinical year undecided about specialty choice and preferred practice location. At the end of the primary clinical year, most students have decided on a specialty and most report wanting to practice in communities similar to where they trained during that year.

Before the primary clinical year student attitudes toward primary care are not significantly different based on selected training site. However, at the end of the primary clinical year, students who had been trained in small communities were significantly more likely to choose primary care compared with students trained in medium to large communities.

Of the students who reported being undecided at the beginning of the primary clinical year, students who had trained in small communities were roughly 10 times more likely to have chosen primary care (66.7 versus 6.7 percent).

This data is consistent with the review of North American studies examining medical student outcomes associated with rural training experiences conducted by Barrett and Lipsky which indicated that rural rotations influence career choice and practice site. Their review showed that placement in rural settings is a positive learning experience that students and preceptors value. While the evidence supports that these rotations influence practice site and career choice, it is not clear whether they reinforce pre-existing interest or have the ability to motivate previously uninterested students to consider a career in primary care or rural medicine.

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Simultaneous Onset of Deep Vein Thrombosis, Pulmonary Embolism, Cerebral Infarction, and Myocardial Infarction in a Patient with Patent Foramen Ovale

By Jimmy Yee, MD; Vishesh Kumar, MD; Alex Pham; Kashif Shaikh, MD; Muhammad Omar, MD; Adam Stys, MD; and Marian Petrasko, MD

Abstract

Paradoxical embolism is a known complication with intra-cardiac shunts. It should be considered in the differential as the pathophysiologic mechanism of simultaneous thromboembolism in the venous and systemic vasculature. We present a case of simultaneous deep venous thrombosis, pulmonary embolism and myocardial infarction in the presence of a confirmed patent foramen ovale on echocardiography. Thrombolytic therapy was administered. Subsequent concerns of intracranial hemorrhage on imaging of the brain complicated the management and added to the challenge of co-managing the clot burden in our patient. This rare presentation highlights the importance of multisystem evaluation in making the best medical decision for the patient.

Introduction

Patent foramen ovale (PFO) is relatively prevalent in the population. Often times they are incidental findings and are benign, but can occasionally cause systemic embolization resulting in catastrophic results. There are numerous case reports of isolated systemic embolization in setting of sudden increase in right ventricular pressures secondary to an acute pulmonary embolism (PE). This can result in cerebral vascular accident (CVA) or myocardial infarction (MI). This case report is unique as the patient presented with simultaneous deep venous thrombosis (DVT), PE, CVA and MI, complicated by possible intracranial hemorrhage secondary to thrombolytic therapy.

Case Report

A 60-year-old male patient without any significant medical history was brought to the hospital with sudden onset of difficulty speaking after his wife had found him on the bathroom floor. The patient had a 40-year smoking history, and had quit smoking one year prior. He had been physically active, and had worked as a middle school custodian. Computed tomogram scan of the brain revealed an acute left middle cerebral artery territory infarct. There was no evidence of hemorrhagic transformation. Computed tomogram scan of the chest (Figure 1) revealed multiple bilateral PE within the distal right and left main pulmonary arteries as well as lobar and segmental branches without overt evidence of right heart strain. There was no aortic dissection or aneurysm. Initial electrocardiogram revealed approximately 1.5 mm inferior ST elevation without reciprocal changes, suggestive of acute early infarction. The patient was intubated for airway protection due to worsening neurological function.

A commonly used thrombolytic agent (alteplase) was administered according to acute ischemic stroke guidelines. Aspirin 300 mg was given through the suppository route. The patient was stabilized, and was transferred to Sanford University of South Dakota Medical Center for a higher level of care.

Upon arrival, the patient had stable vital signs, and was saturating 95 percent on a ventilator with fraction of inspired oxygen of 45 percent, and a temperature 97.2 degrees Fahrenheit. The patient was unconscious on exam. He had no response to noxious stimulus in the right upper or lower extremity and had minimal withdrawal to
pain on the left upper and left lower extremity. Initial troponin was 0.08 ng/mL, and serial troponin five hours later was 128 ng/mL. This was the peak during his hospitalization, and subsequently declined thereafter (64 ng/mL six hours after the second troponin). The rest of the labs were noncontributory. Magnetic resonance imaging of the brain (Figure 2) confirmed an acute left middle cerebral artery infarct along with an acute infarction in the right temporal-occipital region, right thalamus extending into the right corona radiata, inferior aspect of the cerebral hemisphere bilaterally and cortex of the right frontal lobe. There was a small amount of petechial blood in the left putamen and left frontal opercula concerning for possible hemorrhagic transformation.

Due to the complexity of the patient, the decision was made to withhold coronary angiogram given the possibility of intracranial hemorrhage and contraindication for anticoagulation. Repeat electrocardiogram eight hours later showed a resolution of the inferior ST elevation suggestive that reperfusion had been achieved with the thrombolytic therapy. Transthoracic echocardiography showed left ventricular global systolic hypokinesis with an estimated ejection fraction of 30-35 percent, and a moderately hypokinetic, moderately dilated right ventricle without any significant tricuspid regurgitation. Right ventricular systolic pressure could not be accurately quantified due to lack of tricuspid regurgitation. An interatrial shunt with agitated saline confirmed a PFO (Figure 3). Lower extremity duplex ultrasonogram showed evidence of acute DVT involving the proximal femoral veins and popliteal vein of the right lower extremity. An inferior vena cava filter was placed due to contraindication for anticoagulation (possible intracranial hemorrhage).
Coronary angiogram was performed the following day which did not reveal any significant coronary artery disease. Serial computed tomography scan of the head showed stable infarcts without worsening of petechial hemorrhage. The patient’s neurological status did not improve over time. Goals of care were discussed with family members with assistance from the palliative care team, and the decision was to withdraw life sustaining care. The patient passed away shortly after extubation of the endotracheal tube.

Discussion
Paradoxical embolus refers to a thrombus that originates in the venous system (i.e., DVT) and transitions to the systemic system via a shunt, either intracardiac or in the venous system (i.e., DVT) and transitions to the endotracheal tube.

Table 1. Hypercoagulability Workup

<table>
<thead>
<tr>
<th>Labwork</th>
<th>Results</th>
<th>Interpretation</th>
</tr>
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<tr>
<td>ANA</td>
<td>1:80 (diffuse, homogenous)</td>
<td>Possible SLE, not specific</td>
</tr>
<tr>
<td>C3 Complement</td>
<td>110 mg/dL</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>C4 Complement</td>
<td>28 mg/dL</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>Anti-Smith IgG</td>
<td>&lt; 0.2 U</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>SS-A/Ro Ab, IgG</td>
<td>&lt; 0.2 U</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>SS-B/La Ab, IgG</td>
<td>&lt; 0.2 U</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>RNP Ab, IgG</td>
<td>&lt; 0.2 U</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>RPR (Syphilis)</td>
<td>Nonreactive</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>Factor V Leiden Mutation</td>
<td>Negative</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>Anti-Thrombin Activity</td>
<td>97%</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>Protein C Functional Activity</td>
<td>104%</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>Protein S Functional Activity</td>
<td>96%</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>PT G202/10A Gene Mutation</td>
<td>Negative</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>Cardiolipin IgG/IgM Antibody</td>
<td>Normal</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>Anti-Plasminogen Antibody</td>
<td>Normal</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>Lupus Inhibitor Screen</td>
<td>Normal</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>CA 19-9</td>
<td>2 U/mL</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>CEA</td>
<td>3.3 ng/mL</td>
<td>Within normal limits</td>
</tr>
<tr>
<td>PSA</td>
<td>2.42 ng/mL</td>
<td>Within normal limits</td>
</tr>
</tbody>
</table>

In literature, there are a few case reports with paradoxical embolism presenting as MI, or with CVA. This case is unique because the patient presented with simultaneous thrombus burden in four vascular territories (lower extremity, pulmonary vasculature, brain, and coronary arteries), which complicated medical management. The thrombolytic therapy that was administered was effective for the DVT, PE, CVA and MI. Coronary angiogram did not reveal any thrombus and was possibly thrombolysed by the time angiography was done. This was further supported by resolution of the inferior ST elevation on electrocardiogram. Hypercoagulability workup (Table 1) was negative for any significant hypercoagulability.
with the exception of positive antinuclear antibody, which is non-specific. The inciting cause for this patient’s sudden thrombosis remains unclear. The patient did not have any family history of clotting disorders. If he would have survived, a more thorough malignancy workup would have been indicated.

**Conclusion**

Cryptogenic stroke is not an uncommon presentation, and is frequently attributed to a PFO. Our patient presented with rare findings of simultaneous thromboembolisms in four vascular territories. Thrombolytic therapy was administered which was beneficial for the DVT, PE, CVA, and MI. Due to the large CVA, the patient did not recover neurologically. Our patient represents a challenging case and highlights the worst case scenario secondary to a PFO. Despite early diagnosis and response with thrombolytic therapy, the patient did not survive. Paradoxical embolism should always be in the differential in a patient with presentation of simultaneous venous and systemic thromboembolism.

Acknowledgements: We would like to acknowledge Julia Stys, Tereza Petraskova, and James Higgins for their contribution to this paper.

**REFERENCES**


Please note: Due to limited space, we are unable to list all references. You may contact South Dakota Medicine at 605.336.1965 for a complete listing.

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Incidental Finding of Giant Left Ventricular Aneurysm: Case Report and Literature Review

By Muhammad Omar, MD; Shenjing Li, MD; Amornpol Anuwatworn, MD; and Tom Stys, MD

Abstract
Left ventricular aneurysms and pseudoaneurysms are complications of myocardial infarction. With advances in percutaneous coronary intervention, development of thrombolytic agents, and early initiation of treatment with angiotensin-converting enzyme inhibitors to decrease afterload and inhibit left ventricular remodeling, these complications have become much less common. Here, we report an incidental finding of a giant aneurysm of the left ventricle with associated thrombus and mural calcifications in an elderly male patient who presented to his primary care physician for abdominal pain and denied any prior coronary artery disease. In addition, a potential inflammatory mass at the rectosigmoid junction was also found by computed tomography scanning for his abdominal problem.

Introduction
Left ventricular aneurysms and pseudoaneurysms are rare and can result after myocardial infarction. The incidence of left ventricular aneurysms is decreasing with the advent of risk factor optimization, guideline-directed medical therapy, and reperfusion techniques for coronary heart disease. These patients may present with thromboembolic phenomenon, heart failure, and/or malignant arrhythmias. The current case report presents an incidental finding of a giant left ventricular aneurysm and its management.

Case Presentation
A 78-year-old male initially presented to his primary care physician with several months history of intermittent lower abdominal pain without associated hematochezia or melena. His past medical history was significant for hypertension, peripheral vascular disease, hypercholesterolemia, and chronic obstructive pulmonary disease. He continually smoked one pack of cigarettes per day and denied coronary artery disease. Evaluation for aforementioned symptoms included computed tomography, which revealed a potential inflammatory mass at the rectosigmoid junction; this scan also incidentally revealed a large left ventricular aneurysm (LVA) with associated thrombus and mural calcifications. He was referred to a cardiologist for cardiac risk stratification for noncardiac surgery. Retrospective review of a chest X-ray done one year prior showed soft tissue opacity along the cardiac apex, suggesting a LVA. He had mild dyspnea on exertion but denied chest pain, shortness of breath, palpitation, or focal neurologic symptoms. His New York Heart Association Class was II, and physical examination found a non-displaced apical pulse, absent third and fourth heart sounds, grade 2 (out of 6) systolic murmur at the apex without signs of decompensated heart failure. Electrocardiogram showed pathologic Q-waves and T-wave inversion in inferior and lateral leads but no ST-segment elevation. Echocardiogram revealed the left ventricle was dilated with a severely reduced ejection fraction (EF) of 20-25 percent. Inferior and inferoseptal akinesis with aneurysm was detected, and there was mild mitral regurgitation. A stress test showed a partially reversible inferolateral perfusion defect, and subsequent cardiac catheterization revealed total occlusion of the middle right coronary artery, a 90 percent proximal left anterior coronary lesion, a 30 percent proximal circumflex lesion, and large inferior narrow-neck aneurysm. Subsequent colonoscopy showed an infiltrative, ulcerative, and partially obstructing mass in the rectosigmoid colon. Biopsies of this lesion confirmed it was an invasive high-grade adenocarcinoma. He was referred to Mayo Clinic cardiothoracic surgery where he underwent open heart surgery.
surgery for coronary artery bypass grafts and mitral valve bioprosthetic valve replacement. Postoperatively, he suffered a stroke and eventually died from the event.

Discussion

The majority of true LVAs are caused by transmural myocardial infarction (MI). After acute MI, the necrotic cardiac muscles get replaced by fibrotic tissue, resulting in scar formation with thinning of the injured zone, which may, in turn, result in aneurysm formation. Patients are prone to thrombus formation in the aneurysm because of stasis of blood flow in the aneurysm cavity and fibrosed surface. Over half of cases with aneurysms have thrombi in the LVA or inside the fibrotic tissues that increases the risk for systemic emboli. These patients can develop ventricular arrhythmias around these scar tissues which may cause ventricular tachycardia, ventricular fibrillation, and sudden cardiac death. Depending on the size and location of the LVA, patients may develop left-sided heart failure and functional valvular diseases, like mitral regurgitation.

The previously estimated incidence of LVA was 30 percent in patients with transmural MI. Currently, the incidence is less than 5-15 percent because of highly successful revascularization procedures, including thrombolytic therapy, percutaneous coronary intervention, and coronary bypass surgery, along with new therapies, including angiotensin-converting enzyme inhibitors. Left anterior descending coronary artery occlusion without collateral arteries is a major risk factor for LVA resulting in apical and anterior wall aneurysms. About 10-15 percent of LVAs caused by right coronary artery occlusion involve the inferior-basal walls. Other etiologies of LVAs include hypertrophic cardiomyopathy or infective diseases, like aspergillosis and Chagas disease.

Upon physical examination, the following physical findings can be expected: cardiac enlargement with diffuse
apical impulse displaced to the left of the midclavicular line, a third and/or fourth heart sound, a systolic murmur of mitral regurgitation, and signs of left heart failure. Electrocardiography usually reveals Q-waves in culprit coronary territory. There may also be a persistently elevated ST-segment; however, it is not necessary for diagnosis because a small aneurysm would not make this change. Thus, imaging studies are needed to make a definitive diagnosis of LVA. Two-dimensional echocardiography is the first and most widely used imaging modality. It can reveal thin-walled LVAs that are akinetic or dyskinetic during systole and thrombosis in the LVA. It can also help differentiate between true and false aneurysms. Cardiac computed tomography can be useful for identifying transmural thrombosis and calcification and may be better for identifying posterior aneurysms that are difficult to visualize with echocardiography. Moreover, use of cardiovascular magnetic resonance is gaining popularity for diagnosing LVA, as well as assessing myocardial viability and presence of thrombus.5

A LVA may enlarge over time; however, it rarely ruptures because of its dense fibrotic wall. Treatment of LVA involves therapy for coronary disease and related complications, along with aneurysmectomy for symptomatic large LVAs and recurrent complications. Therapeutic intervention is reasonable for small- to moderately-sized asymptomatic aneurysms6 and consists of an angiotensin-converting enzyme inhibitor, anti-ischemic medications for coronary artery disease, and anticoagulation agents for acute LVA thrombus.

The 2013 American College of Cardiology/American Heart Association guidelines on heart failure concluded that left ventricular aneurysmectomy is a Class IIb recommendation for LVAs in patients with intractable ventricular arrhythmias and/or pump failure that is unresponsive to medical and catheter-based therapies.7 Aneurysmectomy aims to resect the diskinetic segment, revascularize, and repair or replace the valve to improve the patient’s clinical condition. Recently, there have been several reports that have compared two major aneurysmectomy surgeries: linear repair versus patch repair. These studies reported no significant differences between early and late survival and New York Heart Association heart failure symptoms between groups.8,9 The choice of surgical technique depends on the location and extent of the scar segment, residual ventricular function, and associated valvular diseases. Old age, an EF less than 30 percent, urgent operation, incomplete revascularization, and history of stroke are independent risk factors for early mortality.

There is no recommendation for patients with a large asymptomatic LVA. It is reasonable to concomitantly repair the aneurysm when coronary artery bypass grafting or valve surgery is performed. Otherwise, they should be treated with the same regimen as those with small LVAs and followed closely for any progressive complications, including malignant arrhythmias, heart failure, and embolic events. In one previous report, the incidence of a clinical embolization in chronic LVA was reported to be 0.35 percent per year after a mean follow-up of five years.10 They concluded that life-long anticoagulation may not be warranted given the low risk for systemic embolizations. As for malignant arrhythmias, endocardial resection and/or cryoablation can be performed. An alternate effective approach is nonguided endocardectomy. This technique has been shown to decrease the chances of spontaneous ventricular tachycardia in a group of 106 patients.11

It is important to differentiate between true LVA and pseudoaneurysms because of their different prognosis. Left ventricular pseudoaneurysm is a more rare complication in patients after MI or cardiac surgery. It is caused by cardiac wall rupture, which is contained by the pericardium without myocardial or fibrotic tissue-like true aneurysms. The clinical presentation is nonspecific, and imaging studies for diagnosis include 2D-echocardiography with and without contrast. A more reliable method, however, is angiography because it can reveal any narrow orifice leading to a saccular aneurysm. Surgery is the preferred treatment. Our patient had a chronic large inferior LVA with mild exertional dyspnea and low EF. He might have had a silent MI in the past with chronic total occlusion of the right coronary artery, proximal left anterior descending disease, and/or mild mitral regurgitation. Unfortunately, he developed a stroke after the cardiac surgery and died of the event.

REFERENCES


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Abstract
Bronchiolitis is among the most common illnesses in infants and children, and is the most common cause for hospitalization in infants in the U.S. This illness can be caused by many viruses, most commonly respiratory syncytial virus. It is diagnosed clinically by history and physical exam findings, with a narrow role for ancillary testing. Management is supportive, with medications demonstrating limited utility in multiple studies. Preventive measures include hand hygiene, breastfeeding, avoiding tobacco smoke exposure, and isolation precautions for hospitalized patients. Palivizumab prophylaxis is recommended for infants with qualifying high risk conditions. Recent evidence-based clinical practice guidelines have been published by the American Academy of Pediatrics to guide diagnosis, treatment, and prevention of bronchiolitis.

Background
Bronchiolitis is one of the most common illnesses affecting infants and children, with 90 percent of children infected with respiratory syncytial virus (RSV) by the age of 2, and 40 percent of these children manifesting lower respiratory tract infection. This illness can be caused by many different viruses, and is characterized by upper and lower respiratory tract symptoms, such as rhinorrhea, cough, wheezing, and respiratory distress. Bronchiolitis is the most common cause of hospitalization among infants in the U.S., with approximately 100,000 hospitalizations annually, costing approximately $1.73 billion. This represents 2-3 percent of all children less than 12 months of age. About 800,000 children in the U.S. are seen in the outpatient setting for bronchiolitis in the first year of life. The highest incidence of disease is December through March in the U.S., with regional variation (South Dakota and the surrounding region are highest between January and May). Bronchiolitis is a significant cause of worldwide childhood mortality, especially in developing countries. In the U.S., there are less than 100 deaths per year from bronchiolitis.

Bronchiolitis primarily affects the terminal bronchioles, with acute inflammation, edema, necrosis of epithelial airway cells, and increased mucous production. The pathogenesis is thought to be related to both cellular injury from the virus and host inflammatory response. Many viruses cause the constellation of symptoms, most commonly respiratory syncytial virus (RSV). Other etiologies include human rhinovirus, parainfluenza, human metapneumovirus, adenovirus, influenza, and coronavirus. Many children (6-30 percent, depending on the study and type of viral testing obtained) show coinfection with two or more viruses. Some studies show increased severity of illness in patients with multiple viruses, but this finding is not consistent. Severe bronchiolitis is associated with an increased risk of later diagnosis of asthma. It is currently unclear if the viral infection leads to lung injury predisposing to asthma, or if there is a preexisting condition predisposing to both asthma and severe bronchiolitis. There is no permanent or long-term immunity with RSV, and reinfections occur throughout life, despite normal host immune responses and no detectable changes in RSV antigens.

The American Academy of Pediatrics (AAP) in 2015 published an updated clinical practice guideline on the diagnosis, management, and prevention of bronchiolitis based on review of a large body of literature. Many of the recommendations from the guideline will be discussed in the present article. The Choosing Wisely campaign, a
Clinical Presentation

Bronchiolitis typically begins with upper respiratory symptoms including rhinitis and cough, and progresses to lower respiratory signs and symptoms such as wheezing, crackles, tachypnea, and increased respiratory effort (grunting, nasal flaring, retractions). Fever may be present, as well as other nonspecific symptoms such as malaise, poor appetite and oral intake, and dehydration. In neonates and young infants, apnea may occur, especially early in the course of illness. The most common age group affected with bronchiolitis is infants under 12 months of age. Age is the most important predictor of severe bronchiolitis, with younger infants more likely to be hospitalized or require intensive care. The highest rate of hospitalization is in infants 30-90 days of age. Other risk factors for severe disease include prematurity (29 or fewer weeks gestation), chronic lung disease of prematurity, and congenital heart disease.

Diagnosis

Bronchiolitis is a clinical diagnosis, based on historical features and physical exam findings, with upper respiratory tract prodrome, followed by increased respiratory effort and wheezing in a child less than 2 years of age. No ancillary studies are needed to make a diagnosis of bronchiolitis and are not recommended by AAP or Choosing Wisely guidelines. Chest radiographs are sometimes obtained, but studies do not show benefit for routine use. There is poor correlation with disease severity or risk of progression of disease, but obtaining chest X-rays increases the likelihood of unnecessary antibiotic therapy, without changing outcomes. However, radiographs may be performed in patients with severe disease requiring intensive care or with signs of airway complication, such as pneumothorax.

Viral studies, including rapid antigen testing, direct fluorescent antibody testing, or polymerase chain reaction assay, are not recommended, as they do not generally contribute to diagnosis or management. Clinical features of disease and response to intervention are indistinguishable between different viral etiologies. In high risk individuals (such as young infants or immunocompromised patients) with symptoms concerning for influenza infection, testing for this virus may be appropriate, as antiviral therapy may be beneficial. In infants receiving monthly palivizumab prophylaxis, RSV testing should be done, and if positive then prophylaxis should be discontinued, due to the low likelihood of repeat RSV infection during the same year. In patient with atypical presentations or severe disease, further testing may be appropriate. For example, in an infant with paroxysmal cough and absence of wheezing, testing for pertussis may be warranted.

Management

The treatment of bronchiolitis is exclusively supportive care. No available treatment has been shown to shorten the course of disease or resolve symptoms. Interventions which are recommended include nasal suctioning, maintaining adequate hydration status enterally or intravenously, and supplemental oxygen if necessary. Most children with bronchiolitis will be managed at home or in the outpatient setting with supportive care. Frequent reasons for hospitalization include severe respiratory distress, dehydration, or hypoxemia. The risk of hypoxemia must be balanced against the risk of hospitalization, as there are published risks of adverse events and near-misses associated with hospitalization. In children with severe respiratory distress or apnea, increased respiratory support such as noninvasive positive pressure ventilation or intubation and mechanical ventilation may be necessary.

Superficial nasal suctioning may provide temporary relief from nasal secretions. Chest physiotherapy shows no clinical benefit and is not recommended. Deep suctioning of the nasopharynx is associated with longer length of stay and is also not recommended. If significant tachypnea is present, especially with copious nasal secretions, the ability to maintain adequate oral hydration may be compromised. In general, either enteral (nasogastric) or intravenous fluid replacement may be given, as studies show similar outcomes.

Providers may elect not to administer supplemental oxygen when oxyhemoglobin saturations are 90 percent or greater. Continuous pulse oximetry is not routinely recommended in the absence of hypoxia, due to lack of benefit as well as potential harms. Satuations are a poor predictor of respiratory distress, and routine use of pulse
oximetry correlates with increased length of stay.\textsuperscript{34-36} Transient desaturation is normal for healthy infants.\textsuperscript{37} In one study, continuous pulse oximetry led to unnecessarily prolonged hospitalization in one in four patients hospitalized with bronchiolitis in the absence of other symptoms, with no evidence of benefit.\textsuperscript{34} Risks of pulse oximetry include frequent alarms which can adversely affect family and alarm fatigue for staff. It may also lead to less effective surveillance of the severity of illness, with staff relying on oximetry rather than fully reassessing the patient.\textsuperscript{38}

The recent AAP guidelines strongly recommend against routine use of bronchodilators and corticosteroids, as the literature does not suggest that these interventions improve outcomes.\textsuperscript{39} Multiple large randomized, controlled trials and systematic reviews give clear evidence that corticosteroids do not provide significant benefit for children with bronchiolitis.\textsuperscript{39} Use of albuterol and/or racemic epinephrine has been evaluated in multiple studies, without showing consistent effects on resolution of disease, need for hospitalization, or length of stay.\textsuperscript{40, 41} Of note, most studies of bronchodilators have excluded children with respiratory failure, so these recommendations may not generalize to this specific population. Potential adverse effects of $\alpha$- and $\beta$-agonist therapy such as tachycardia, tremors, and cost outweigh the potential benefits. Epinephrine should not be used in hospitalized children with bronchiolitis; it could potentially be used as a rescue medication in severe disease, although there is currently no recommendation for or against its use in this situation.

Antibiotics should not be used, except in the case of bacterial infection. Acute otitis media may be present, and should be diagnosed and treated according to published guidelines.\textsuperscript{6} The risk of serious bacterial infection (urinary tract infection, bacteremia, or meningitis) is low in patients with bronchiolitis, and routine screening is not generally needed, especially in infants greater than 30 days of age. The risk of invasive bacterial infection (meningitis or bacteremia) in a patient with a distinct viral syndrome like bronchiolitis is extremely low (less than 1 percent), much lower than in febrile infants without an obvious source of fever (up to 7 percent).\textsuperscript{33, 44} Bacterial pneumonia is unusual in bronchiolitis, although antibiotics may be justified in children with respiratory failure requiring intubation and mechanical ventilation.\textsuperscript{46, 47}

Nebulized hypertonic (3 percent) saline has also been studied in recent years, with studies showing conflicting results. Hypertonic saline increases mucociliary clearance.\textsuperscript{48-50} Earlier studies suggested that its use may improve symptoms and decrease length of stay in situations where length of stay is greater than three days; however, in the U.S., the hospitalization is generally of shorter duration and these results may not be generalizable.\textsuperscript{51} It should not be used in the emergency department setting, but guidelines suggest that it may be used in hospitalized patients.\textsuperscript{19} A recent meta-analysis published after release of the AAP guidelines shows lack of improvement in respiratory scores or length of stay.\textsuperscript{52}

### Prevention

Hand hygiene is the primary form of prevention, with either alcohol-based rubs or soap and water.\textsuperscript{53, 54} Gloves and gowns should be used when caring for hospitalized patients to decrease the risk of cross-infection, with masks used when exposure to aerosolized secretions is anticipated.\textsuperscript{55} Smoking cessation should also be counseled for caregivers when appropriate,\textsuperscript{19} as tobacco smoke exposure increases the risk and severity of bronchiolitis.\textsuperscript{56, 58} Breastfeeding should be encouraged (with exclusive breastfeeding for the first six months), as this has been shown to decrease the risk of respiratory illnesses, in addition to its other benefits.\textsuperscript{59, 60} Influenza immunization is recommended as per Center for Disease Control and Prevention guidelines, but this virus is a less common cause of bronchiolitis. At present, there is no other vaccine which plays a role in the prevention of bronchiolitis.

New recommendations regarding the use of palivizumab are available, and the updates limit use to a select group of infants.\textsuperscript{19, 31} Palivizumab is a monoclonal antibody, licensed by the Food and Drug Administration in 1998, used for passive immunization against RSV to protect against serious lower respiratory tract infection. It shows neutralizing and fusion-inhibitory activity against RSV, inhibiting replication of the virus. Palivizumab injections should be given monthly for five months during RSV season for infants who qualify. Premature infants born before 29 weeks 0 days gestation who are less than 12 months of age at the start of RSV season should receive palivizumab prophylaxis. In addition to prematurity, other qualifying conditions for children in the first year of life include hemodynamically significant congenital heart disease and chronic lung disease of prematurity (defined as less than 32 weeks gestation and requiring greater than 21 percent FiO2 for at least the first 28 days of life). Other premature infants should not be given palivizumab unless they meet
the above criteria. Data regarding use of palivizumab in children with other conditions such as neuromuscular disease, other pulmonary abnormality, or immune compromise are limited, and prophylaxis may be considered. Routine prophylaxis is not recommended for children with trisomy 21 or cystic fibrosis in the absence of other qualifying criteria. Prevention of RSV infection with immunoprophylaxis has no effect on future episodes of wheezing.21

Summary

Bronchiolitis is a very common illness in infants and young children, and is the most common reason for pediatric hospitalization. Evidence-based guidelines have been published based on a large and growing body of medical literature. This viral illness should be diagnosed clinically based on history and physical exam findings, and management is supportive. Preventive measures include hand hygiene, breastfeeding, avoiding tobacco smoke exposure, and isolation precautions for hospitalized patients. Passive immunization with palivizumab should be administered to infants with qualifying high risk conditions.

REFERENCES


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Extenuating Circumstances:

Children of the Nations: A Capstone in Humility, Compassion, and Patient Care

By Elizabeth Hultgren, MD, PhD; and Elizabeth Helsper, MD

Children of the Nations (COTN) is a Christian nonprofit focused on providing physical, educational, social, and spiritual growth to people of countries in need. Through offering medical relief and facilitating educational opportunities, COTN supports their vision of raising children who will transform nations. Founded in 1995, the organization is actively involved in five countries, providing support to thousands of people throughout many villages and communities. Over the past several years, Sioux Falls, South Dakota, has sent 20 teams and raised $2 million to support COTN efforts.

Our 2016 medical mission team comprised a general surgeon and an orthopedic surgeon, two physician assistants, two anesthetists, three medical students, two PACU nurses, one scrub tech, and a multi-talented individual who served as listener, teacher, and autoclave master (Figure 1). As first-time participants, we (the medical students) were unaware of what we were going to encounter in Barahona, Dominican Republic.

Along the beautiful Caribbean shoreline were disheveled villages and impoverished people with restricted health care access due to political and financial barriers. These underprivileged people had learned to live without many of the commodities we often take for granted, including clean water, transportation, and medication. Always patient and grateful, the people of Barahona illustrated the importance of having a positive attitude, especially in adverse circumstances – a notion in which our medical team grounded themselves.

Before the trip, Dr. R. Bradley Reeves and the orthopedic team received X-ray images of probable surgical cases. Notably, one film revealed a severely comminuted, intra-articular distal humerus fracture, a difficult fracture to repair. As with most of the cases we encountered, this fracture was several months old with distorted, fibrotic anatomy. The procedure was long and overwhelming, as we had limited access to hardware, surgical tools, and


Figure 2. Dr. Elizabeth Hultgren and Dr. Kirke Wheeler in the operating room.
imaging. Yet, the perseverance and innovation displayed by Dr. Reeves gave this woman a chance to regain a functional arm and a full life, something that would not have been possible without COTN.

The general surgery team, led by group captain Dr. Kirke Wheeler, was forced to take a flexible approach to the week as we saw patients on a rolling basis as determined by the COTN clinic staff (Figure 2). During the five days spent operating, we performed over 35 general surgeries ranging in complexity from open cholecystectomies for chronic gall bladder disease, to long-standing hernias, to lipomas the size of tennis balls. Nothing was off limits.

Our patients ranged in age from 3-72 and lived within a several-hour radius of our clinic. One of the biggest surprises of the trip was the resilience seen in the people of the Dominican Republic. Open cholecystectomies normally require several postoperative recovery days in the hospital. However, the patients would have the procedure done, recover for a few hours with IV pain medications, and then travel home by bus, car, or by whatever form of transportation they could acquire, without much more than Tylenol and ibuprofen. The resourcefulness and internal resolve of the Barahona people was, in a word, inspiring.

Reflecting upon our past several years of medical training, we decided there is no better capstone than providing care to those in need, the exact concept that got us started in medicine. This trip would not have been possible without the love and compassion of each team member, always willing to let God shine through their actions and attitude. We returned from this mission trip humbled by the character of the people, reinvigorated with our passion for medicine, and with a new appreciation for the generous medical providers in Sioux Falls.

We strive, in our future medical practices, to mirror the perspective we gained in Barahona: service with a positive attitude.

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Venous thromboembolism (VTE) is a common and serious complication among patients with cancer. This is made evident by an overall incidence between 5-20 percent, which is several-fold higher than that of the general population. This observed increase in incidence is attributable to a hypercoagulable state precipitated by an interplay of patient-, cancer-, and treatment-related factors. Regardless of the underlying etiology, the development of VTE has been shown to increase the likelihood of death in cancer patients by upwards of six-fold. Such increases are thought to be due to patients with VTE having more aggressive malignancies, extensive comorbidities, or succumbing to complications of VTE and/or its treatment.

The observed increase in incidence and impact on mortality has prompted the development of preventative strategies to lessen the burden of this complication. At the current time, indications for routine VTE prophylaxis include patients with multiple myeloma receiving treatment with immunomodulatory medications (e.g., thalidomide, lenalidomide), patients with a history of unprovoked VTE, and patients with active cancer who are hospitalized or undergoing surgery. To expand upon these indications, the Khorana model has been developed and validated as a predictive model for chemotherapy-associated VTE in ambulatory oncology patients. The Khorana model utilizes a score calculated by assigning risk points based on the site of primary cancer, pre-chemotherapy platelet count, hemoglobin level or use of erythropoietin stimulating agents (ESAs), pre-chemotherapy leukocyte count, and body mass index (BMI). Based upon the calculated score, patients are assigned to low risk (0 points), intermediate risk (1-2 points), or high risk (3 points and greater) groups. Risk of VTE in each of the categories was found to be 0.8-3 percent, 1.8-8.4 percent, and 7.1-41 percent, respectively. Several clinical trials evaluating the use of prophylactic low-molecular-weight heparin (LMWH) have displayed a lower incidence of symptomatic VTE with variable effects on bleed risk when compared to placebo. Based upon this information, current guidelines state that patients with cancer at high risk for VTE (according to the Khorana model) could be considered for outpatient VTE prophylaxis on an individual basis. However, VTE prophylaxis in the majority of cancer outpatients receiving chemotherapy remains controversial due to a higher bleed risk within this population. Moreover, the increased cost and reduced quality of life (e.g., need for daily injections) associated with thromboprophylaxis further deters from their routine use.

Even with prophylactic measures in place, the risk for developing VTE remains. As a result, it is imperative to have an understanding of appropriate therapeutic strategies, as well as the clinical considerations and limitations associated with each. Current guideline recommendations for management of VTE in cancer patients are relatively consistent. At the current time, LMWH is the recommended therapy for VTE in cancer patients. Recommendations for initial therapy stem from a recent meta-analysis, which displayed a small, yet significant, reduction in mortality with LMWH when compared to unfractionated heparin (UFH) at a three-month follow-up. Nevertheless, no significant difference in VTE recurrence was found to exist between the two agents. In addition to a potential mortality benefit, LMWH does not require hospitalization and routine monitoring, which adds to their appeal over UFH. However, UFH still remains a therapeutic option for those with renal dysfunction or an anticipated need for immediate discontinuation/reversal of anticoagulation.

Following initial therapy, continued anticoagulation is recommended for upwards of three to six months following diagnosis of VTE. Although both LMWH and vitamin K antagonists (warfarin) are recognized as appropriate therapy options, LMWH is preferred. This is made evident through several studies that reported a significant reduction in...
in recurrent VTE in patients receiving therapy with LMWH compared to those treated with warfarin.\textsuperscript{16,18} It is important to note, however, that the resultant risk reduction did not translate to a mortality difference between groups. Additionally, no significant difference in bleed risk was found to exist between LMWH and warfarin therapy.\textsuperscript{16,20}

The decision to utilize LMWH over warfarin is further simplified provided the multiple obstacles accompanying warfarin therapy. Unlike LMWH, warfarin therapy requires routine lab monitoring to ensure a therapeutic INR between 2-3. Although this lab test can be obtained monthly in stable patients, chemotherapy and its associated adverse effects (e.g., nausea, vomiting, diarrhea, decreased appetite) make it difficult for most cancer patients to maintain a therapeutic INR, thus necessitating more frequent testing.\textsuperscript{21} Nevertheless, these shortfalls can be quickly overshadowed by renal function limitations, the need for subcutaneous injections, and the substantially higher cost associated with LMWH therapy.

In light of the aforementioned limitations with both LMWH and warfarin therapy, there has been much interest surrounding the use of direct oral anticoagulants (DOACs), which include direct thrombin inhibitors (dabigatran) and direct factor Xa inhibitors (rivaroxaban, apixaban, edoxaban). Much of this intrigue stems from their oral route of administration, rapid onset/offset of therapeutic effect, predictable pharmacokinetics, absence of routine monitoring, and less drug interactions (compared to warfarin).\textsuperscript{22} Despite the abundant interest, there is a deficiency of clinical experience and research to guide the safe and effective use of these agents in cancer patients. This lack of data is due to the fact that many of the landmark trials that compared the safety and efficacy of these agents to warfarin either excluded or included only a small number of patients with cancer.\textsuperscript{23,26} Nevertheless, a recent meta-analysis extracted data from these trials to assess use in patients with cancer, and concluded that DOACs appear to be as safe and effective as warfarin for the treatment of VTE in patients with cancer.\textsuperscript{22} Until prospective randomized trials have been conducted to compare these agents to LMWH and warfarin, current guidelines recommend against use of DOACs for management of VTE in cancer patients.\textsuperscript{6,9}

As can be seen, prevention and management of VTE in cancer patients, though seemingly simple, is often convoluted with many important clinical considerations and decisions. Nonetheless, there is potential for these decisions to become easier following further research of DOACs within this patient population. Until further research is available, LMWH remains the guideline supported drug of choice for treating VTE in patients with cancer.

### References


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**About the Author:**
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South Dakota Board of Medical and Osteopathic Examiners

- Protects the health and welfare of the state’s citizens by ensuring that qualified medical health care professionals are licensed to practice in South Dakota
- Licenses and regulates over 9,000 licenses within fourteen different medical categories
- Co-regulates medical professions with the Board of Nursing
- Establishes regulations by proposing legislation and adopting administrative rules
- Supports and promotes the Health Professionals Assistance Program that monitors the recovery and/or rehabilitation of impaired healthcare providers
As a teenager, like many others, I yearned for independence and resisted my parent’s rules and restrictions. Now I realize my parents struggled with how much freedom to allow me while best guiding me into adulthood. It’s an old story: kids want freedom; parents are reluctant to give up control. Think back when you first obtained a driver’s license and borrowed the family car. Remember, after some error in judgement or indiscretion, how the car-privilege was taken away and, even when justified, how devastating that was?

Now the tables may be turned, and the aging parent is threatened or devastated by losing the car-privilege after some error in judgement or just because of advanced age.

As a geriatrician, I have heard too many adult children ask me to tell their parents to stop driving. To the adult child this is protecting his dad. To the elderly person, this is a double blow, losing the car-privilege feeling of independence and the freedom to be mobile. Think about it; who’s more dangerous on the road: an 18-20-year-old male in a muscle car, a 16-year-old female with a cellphone, or grandma?

There are three lessons here: first, elderly persons who are ‘competent’ should be allowed to make their own choice when to stop driving. In my years of practice, I have advised many competent elderly people, “If you think you might be putting others or yourself at risk, then you decide when to stop or cut back on driving.” When night vision is poor, neck flexibility is reduced, reflexes are slowed, hearing is poor, posture is bad . . . then think about it. If you can’t decide, or if this is a borderline question, consider a driver improvement course for seniors through the American Automobile Association (AAA) and test yourself. Then you make that choice.

The second lesson, elderly persons who are not “competent” need not to drive. When their “learn-a-new-thing” memory is poor and when accidents start piling up, it’s time for someone step in. The elderly person first needs to see the doctor for evaluation. Afterwards, if declared incompetent, it means no driving, will-making, check-writing, or consenting to an operation.

The third lesson is for everyone and every family to realize how important is the freedom to drive, especially for individuals trying to grow up with independence or age with dignity. We should all recognize what a precious freedom and right it is to drive.

REFERENCES
https://www.cdc.gov/motorvehiclesafety/older_adult_drivers/
Cultural diversity is present in all areas of our lives, especially health care. The Great Plains area is comprised of many diverse races and cultures which depict a culturally broad spectrum when providing health care to patients. With many cultural backgrounds within our region, it is important to recognize the various beliefs, traditions and values to provide quality care for patients and minimize miscommunication and misunderstanding.

In grade school, you may have been taught the Golden Rule which states, “treat others how you would like to be treated.” In health care, instead of the Golden Rule, the Platinum Rule should be applied. The Platinum Rule states, “treat others as they would want to be treated.” This concept introduces cultural awareness as it incorporates the idea of thinking about the patient and how he or she wants to receive health care. The latter view of thinking challenges health care professionals to consider how the patient wants to be treated regardless of their personal views or beliefs. This provides a more empathetic view to health care and builds trust through increased understanding and respect for the patient’s cultural practices and preferences.

For example, in some Native cultures it is considered disrespectful to make eye contact with an elder or to provide a firm handshake. Another example would be addressing a patient by their first name. The patient may want to be addressed by “Mr.” or “Mrs.” based on their cultural preference. Disrupting a patient’s cultural norms may cause the patient to feel uncomfortable and eventually develop a lack of trust of the health care provider.

In both cases, the physician can use the Platinum Rule to adjust personal preferences to accommodate for the patient’s beliefs, traditions, religious background or ideals. Since these examples may not be universal for all ethnicities and races, it is best to ask the patient what cultural preferences he or she may have when considering health care. An example statement that can be used in order to gain a better cultural understanding of a patient is:

“Are there any cultural preferences I should be aware of to ensure you are comfortable with the care I provide?”

Developing cultural awareness can improve patient care by reducing barriers of misunderstanding and miscommunication. Creating statements that will allow the patient to voice their own beliefs may reduce those barriers and provide a better form of communication between the patient and physician. Incorporating cultural awareness into patient care may prove to be extremely beneficial when seeking to understand the different backgrounds and beliefs of individual patients.

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For Your Benefit:

Get Involved in the SDSMA

Thank you for your membership in the South Dakota State Medical Association. As a member, you have several direct opportunities to become more involved in the important work of the SDSMA:

Doctor of the Day – serve as the physician for the South Dakota State Legislature for one day during session;

Physician lobbyist – serve as a volunteer lobbyist during the legislative session;

SDSMA PAC – help friends of medicine become elected officials and lawmakers;

SDSMA committees and task forces – serve the organization and yourself;

SDSMA appointments to state boards, committees and commissions – the SDSMA is asked to nominate and recommend physicians to fill positions to numerous vacancies every year;

Membership sections for medical students, residents, young physicians, and senior physicians – needs vary at different points throughout a physician’s career, and we need leaders at each stage; and

Districts and specialty societies – for local involvement.

If you’d like to get involved, give us a call at 605.336.1965 or visit www.sdsma.org for more information.

“For Your Benefit” is the SDSMA’s monthly update on programs and services available to members.

Robert E. Van Demark, Jr., MD, Sworn in as SDSMA President

Robert E. Van Demark, Jr., MD, became the 136th president of the SDSMA on June 2, 2017. He has been a member of the SDSMA since 1983.

Dr. Van Demark is an orthopedic surgeon at Sanford Orthopedics & Sports Medicine in Sioux Falls. He is the head of the Section of Orthopedics and Clinical Professor (Department of Surgery) at the University of South Dakota Sanford School of Medicine.

Dr. Van Demark has been involved in the leadership of organized medicine for several years. Prior to becoming SDSMA president, he held offices within the SDSMA’s Executive Committee and served on the SDSMA Council of Physicians (now re-named Policy Council) as a councilor and alternate councilor. He is also past president of the South Dakota State Orthopaedic Society and is a member of the American Society for Surgery of the Hand and the American Association of Hand Surgery. In 2013, Dr. Van Demark was recognized as the Sanford USD Medical Center Service Excellence Doctor of the year.

Dr. Van Demark has volunteered for the SDSMA’s advocacy efforts during the state legislature by participating as a volunteer lobbyist. He serves as chair of the SDSMA’s special Committee on Pain Management and Prescription Drug Abuse, where he has led efforts to address the problem of prescription drug abuse and oversaw the publication of guidelines for physicians to effectively treat pain and minimize patient risk.

Dr. Van Demark received his medical degree from Tufts University School of Medicine in Boston. He completed an internship at McKennan Hospital (now Avera McKennan Hospital & University Health Center) in Sioux Falls, a residency in orthopedic surgery at Mayo Graduate School of Medicine in Rochester, Minnesota, and a fellowship in hand surgery in Los Angeles.

Dr. Van Demark and his wife, Marilyn, have two daughters: Katie, an anesthesiologist at Avera McKennan, and Sara, a dentist who lives in Rochester, Minnesota. They also have one son, Rob, who is completing an orthopedic trauma fellowship and will be joining Sanford Orthopedics & Sports Medicine in the fall of 2017.
Keep Your Information Up-to-Date: Log in Today

In order for the SDSMA office to provide members with timely information, it is important that members regularly review their contact information on file with the SDSMA. Have you changed practice locations? Is your email correct? Is your mail going to the right place?

All SDSMA members have an existing online profile. Visit www.sdsm.org and log into your secure online account. Next, access your profile by clicking the “Update my Profile” link at the top of the page.

Please take a few minutes to review your profile and make any necessary updates. Updating your account keeps your information up to date and notifies the SDSMA of any changes so you are accurately listed in the member directory and ensures that your membership materials, emails and renewal notices are sent to the appropriate mailing and email addresses.

Do you have a new photo? Updated photos can be uploaded to your user account or emailed to membership@sdsm.org.

South Dakota Health Insurance Coverage Facts

There were 4,200 more individuals in South Dakota with health insurance coverage in 2015 than in 2013, according to the Kaiser Family Foundation. From 2013 to 2015, the uninsured rate in South Dakota fell from 10 percent to 9 percent.

When it comes to plans through the exchange, advance premium tax credits and cost-sharing reductions provided assistance to thousands of South Dakota residents. As of the end of the 2017 open enrollment period, 29,622 individuals selected a plan on the Health Insurance Marketplace. The number of people who had premiums reduced by the advance premium tax credit was 26,605 and 17,286 people qualified for cost-sharing reductions.

The average per person premium for all consumers, before the application of tax credits, was $541.

The South Dakota Department of Social Services enrolled 120,093 individuals in Medicaid and CHIP as of February 2017, a net increase of 4 percent since October 2013. Seventy percent of Medicaid enrollees in South Dakota are in working families.

Source: AMA, Kaiser Family Foundation

Legal Brief Highlight: Abortion

While physicians, nurses, and hospitals are not required to perform, assist, or provide facilities for abortions, they must follow the statutory regulations if they choose to do so.

Prior to performing an abortion, a physician has a common law duty to determine a patient’s consent is voluntary and informed. In addition, South Dakota law requires an initial physician consultation and written patient consent, followed by a 72-hour waiting period. Medical emergencies and the performance of an abortion on a minor are handled differently and are regulated by specific statutory provisions. State law also requires physicians to file annual reports regarding the consent obtained from patients and the procedures performed. More information, including additional regulations by weeks, is available in the SDSMA legal brief The Performance of an Abortion at www.sdsm.org. Through the SDSMA Center for Physician Resources, the SDSMA has developed more than 50 legal briefs that are available to members. In addition, the Center develops and delivers programs for members in the area of practice management, leadership and health and wellness.
The Centers for Medicare and Medicaid Services (CMS) is reviewing claims and letting practices know which clinicians should take part in the Merit-based Incentive Payment System (MIPS). MIPS is part of the new Quality Payment Program. The Quality Payment Program replaces Medicare’s sustainable growth rate formula.

During this first year moving to the Quality Payment Program, CMS is working with clinicians on the reporting and participation process. The following are eight ways to know who is included in the Quality Payment Program:

1) Visit qpp.cms.gov, click on the MIPS Participation Look-up Tool, and use your National Provider Identifier (NPI) to check your status. Also, physicians and other providers may have recently received a letter from Medicare explaining who is included in MIPS, including the MIPS participation status of each clinician associated with a practice’s taxpayer identification number (TIN).

2) You’re a physician (includes doctors of medicine, doctors of osteopathy (including osteopathic practitioners), doctors of dental surgery, doctors of dental medicine, doctors of podiatric medicine, doctors of optometry, and chiropractors), physician assistant, nurse practitioner, clinical nurse specialist, certified registered nurse anesthetist, or part of a group including such clinicians.

3) You’re a MIPS eligible clinician that bills $30,000 or more in Medicare Part B allowed charges a year and provides care to more than 100 Part B-enrolled Medicare beneficiaries a year. If you did both, you’re part of MIPS for the 2017 transition year. CMS determined billing and patient volume by using claims data from September 1, 2015 through Aug. 31, 2016. CMS will identify additional low-volume clinicians using claims data from Sept. 1, 2016 through Aug. 31, 2017.

4) You’re not new to Medicare in 2017. If you are new in 2017, you’re not part of MIPS.

5) Your practice tells you the group you’re a part of is participating. Each practice should let its clinicians know their MIPS status. If you practice under more than one TIN, you’ll hear about your status for each TIN. Your status can be different across TINs. For example, you might be part of two practices with different TINs. Your Medicare billing and patient count might be more than the low-volume threshold at one practice, but not at the other practice.

6) Your practice chooses to participate in MIPS as a group. If your group does choose to participate, you’ll be assessed and scored as a group.

7) You didn’t participate sufficiently in Advanced Alternative Payment Models (APMs) and become a Qualifying APM Participant (QP). If you did, you’re exempt from participating in MIPS. If you’re in an Advanced APM and become a Partial QP, you may choose whether to report on MIPS measures and activities, be scored using the APM scoring standard, and be subject to a MIPS payment adjustment. Partial QPs can choose not to participate in MIPS, but they still have to meet the participation requirements of their APMs.

8) You want to participate. Even if you don’t have to participate in the MIPS program, you can still choose to participate. If you do, you won’t be subject to MIPS payment adjustments.

The Quality Payment Program has the following free resources available to help:

- Visit the official CMS website at qpp.cms.gov
- Email qpp@cms.hhs.gov
- Call 866.288.8292
- TTY 877.715.6222

Source: CMS

“The Issue Is” is the SDSMA’s monthly update on key policy issues of importance to physicians.
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To refer a patient, call 1-87-SURVIVAL. Participants can enroll at Edith Sanford Breast Center in Sioux Falls, SD.

Cancer Breakthroughs 2020 is the nation’s most robust cancer initiative seeking to accelerate research on immunotherapy as a standard of care for cancer patients.