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Jose Santos, MD
Physical Medicine & Rehabilitation Physician

Adil Shaikh, MD
Physical Medicine & Rehabilitation Physician

3. Non-surgical options are exhausted first to address symptoms and allow time for the body to heal. Most patients recover well without needing surgery.

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Wissam Asfahanii, MD
Neurosurgeon

4. If non-surgical methods aren’t effective, surgery is then considered. Five physicians at the Avera Spine Center perform a number of specialized surgeries to address back and neck problems.

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Neurosurgeon

Michael Puumala, MD
Neurosurgeon

Daniel Tynan, MD
Neurosurgeon

5. Before surgery, the patient will receive education about the surgical process from our community educator. After surgery, she will explain to the patient his/her recommended recovery plan which will include physical therapy, activity guidelines and follow-up procedures.

Nancy Klinkhammer, PT
Care Coordinator
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Correction
In the January 2016 article, “A Case of Hepatotoxicity Related to Kombucha Tea Consumption,” the authors’ designations were incorrect.

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In this month’s issue of South Dakota Medicine, Peter Chang, a Pillar II (MS III) student at the University of South Dakota Sanford School of Medicine discusses the new Longitudinal Integrated Clerkship (LIC) from a current student’s perspective. I strongly recommend this editorial to our readership because for the first time it gives us insight into the effectiveness of the new medical school curriculum as perceived by our students. It is important to understand, however, that curriculum changes occurred across all four years of our medical school. Instead of breaking down the curriculum by four years, we now break it down by three pillars.

Pillar I is the equivalent to the traditional basic sciences education, but is shortened to 17 months in duration. In addition, after having two foundational courses, the students study each system in block format (for example, cardiovascular, nephrology, endocrinology, etc.). Within each system, concepts relating to the physiology, pathophysiology, pharmacology, etc., of these systems are explored. Emphasis is placed on active learning, meaning students are more active in the classroom, identifying problems, learning issues, and then reporting to their group. Gone are the days where the professor stands in front of the room, lectures for eight hours, and students then regurgitate what they learned on an examination. The sessions are very interactive and more conducive to sustained learning. In addition, students are exposed to much more clinical medicine in these 17 months. Each organ system is led by a basic science professor as well as a clinician. Many of the learning activities are case based. These activities help to prepare the student to be an active member of the clinical team when they enter Pillar II.

Pillar II is the year of intense clinical training our students receive, and is called the LIC. It has been well described elsewhere. This is a dramatic change in medical education, and one which has been somewhat difficult to accept by some. It is primarily ambulatory based, and one criticism is that students do not get enough inpatient experience to prepare them for residency. One must keep in mind, however, that unlike years past, most medicine is now practiced in an ambulatory setting. In addition, as noted by Mr. Chang, students have more of an opportunity to follow patients and disease states over time, learning and understanding more about the natural history of the diseases they see. In addition, and importantly, they begin to form their own professional identities. The importance of professionalism, culture and diversity, ethics, and quality and outcome assessment is stressed. As one who oversees these students’ experiences, it is a pleasure to watch them grow not only academically, but professionally. Students are exposed to hospital medicine in the form of “mini-blocks” in Pillar II, and also are encouraged to follow their patients when admitted to the hospital. Further exploration of hospital medicine can also occur in Pillar III.

Pillar III is a unique opportunity for the medical student to enhance and fully develop their undergraduate medical education. It consists of 15 months, and allows students to delve more deeply into areas of interest through electives and an expanded opportunity to perform research. Plans are underway to offer a more diverse selection of elective opportunities in Pillar III, such as a certificate in bioethics, a course on advocacy, topics on public health, and many others. In addition, students can build on their foundation of knowledge gained in Pillar II, and explore in depth inpatient care of the patient if desired. In the previous curriculum, students would have only 12 months to do electives, and much of that time would be spent interviewing for residency programs. It is hoped this new curriculum will allow the more mature student to better explore specific areas of interest, and better prepare them for modern day residency.

In the November 2015 issue of this journal, Beard, Bunger, and Lindemann described some preliminary outcomes regarding the LIC in Pillar II. In this issue, Mr. Chang gives us our first insight into what our students are feeling as participants in the process. It is vital we listen to feedback from our students, both positive and negative, to ensure our new curriculum best fits the needs of the modern student. I look forward to further insights after our students have completed Pillar III and move on to their residency programs. It is by this process we will begin to learn if the goal of creating skilled, confident physicians who are able to practice medicine in the modern era is realized.

REFERENCES

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Longitudinal Integrated Clerkship: A Student’s Perspective

By Peter Chang, MSIII

The new clinical clerkship model adopted by the University of South Dakota Sanford School of Medicine affords its medical students the unique opportunity to integrate each of the seven core disciplines of clinical medicine throughout the entire year. The new Longitudinal Integrated Clerkship (LIC) model of clinical medical education allows Pillar II (previously called Third-Year) students to rotate across different disciplines of core clerkship medicine each week throughout the year. A sample schedule is depicted in Figure 1. The goal of this change in clerkship style is to promote longitudinal exposure to medical conditions and diseases, encourage inter-disciplinary learning, and provide students with stronger relationships with clinical faculty. The ultimate goal of the LIC is to promote a patient-centered illness model in order to achieve continuity of care and inter-disciplinary learning.

After experiencing the LIC, I believe that the new clinical medical curriculum is accomplishing all of these goals. As a new Pillar II student, I embarked on my clinical education intimidated by the daunting task of preparing for, reading about, and interacting in all seven of the core disciplines simultaneously. However, as my exposure to diverse patient populations grew, I found that the clinical knowledge I gained over time was indeed resilient and multi-disciplinary. The combination of seeing a patient’s disease process, reading and re-reading about the illness, seeing a similar disease process in another clinic, and following the patient in a longitudinal fashion solidified my Pillar II clinical knowledge. At the end of the LIC, students are able to think in a multi-disciplinary approach, instead of within a compartmentalized clinical knowledge approach promoted by the traditional-style clerkship model. Throughout the LIC curriculum students also follow “panel patients.” The longitudinal experiences I was able to have with a few “panel patients” was rewarding in terms of both furthering my education and helping me empathize with my patients’ suffering and illness. Students are now able to get email notifications when their patients are admitted to the hospital so that students can follow their “panel patients” in the inpatient setting as well as the outpatient setting. The LIC also provided me with the opportunity to build strong bonds with the clinical faculty since I worked with my attending physicians for one year compared to a few weeks or months offered by the previous clinical model. Many of the attending physicians that I worked with became my mentors and have provided me with career advice and support, which is invaluable to me at this point of my training in medical school.

In addition to the clinical experience, the LIC is composed of projects to help students become mature, well-rounded, future physicians. The projects include a professionalism paper, journal clubs, an ethics paper, ethics seminars, a multi-disciplinary palliative care seminar, a radiology project, cultural immersion experiences, and a quality and safety Institute for Healthcare Improvement (IHI) research project. The newest addition to the LIC is the quality and safety IHI research project. Throughout the course of the year of LIC, students also have “white space.” This “white space” time is self-directed learning time. Students can choose what clinical activities they want to be involved in or to work on research projects. For many students this “white space” time serves as an outlet to discover multiple specialties that they are not exposed to during the LIC. It can also serve as an opportunity to engage in a specialty of medicine students may have an interest in pursuing. “White space” can be an essential tool in strengthening areas of clinical weakness, exploring new specialties, or engaging in extra activities such as research.

Overall, from a student’s point of view the LIC is a step in the right direction in the dynamic field of both medical education and medicine. The end-point goals and outcomes are being met consistently throughout the three years since the LIC’s inception in 2013, and the future of the LIC curriculum is a bright one as it continues to develop and evolve.

<table>
<thead>
<tr>
<th>Figure 1. Sample LIC Student Schedule</th>
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About the Author:
Peter Chang, MSIII, University of South Dakota Sanford School of Medicine.
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False Negative Urine Pregnancy Testing with Complete Molar Pregnancy: An Example of the Hook Effect

By Zachary Anderson, DO; Eric Larson, MD; Muhammad Khan, MD; and Maria Bell, MD

Abstract

Introduction: Gestational trophoblastic disease (GTD) encompasses a group of tumors derived from trophoblasts, which normally form the placenta during pregnancy. Human chorionic gonadotropin (hCG) is a glycoprotein composed of an alpha (α) subunit identical to that of thyroid stimulating hormone (TSH), follicle-stimulating hormone (FSH), and luteinizing hormone (LH). Detection of beta-hCG is achievable in both urine and serum samples, proving useful for the detection of normal pregnancy and GTD. However, in the presence of very high levels of beta-hCG, a false negative result may be obtained due to a phenomenon called the “hook effect” or “prozone phenomenon.” In certain circumstances, trophoblastic tumors can produce very high levels of beta-hCG, causing misleading results on urine pregnancy testing.

Case presentation: A 49-year-old Caucasian female with past medical history pertinent for deep vein thrombosis, ovarian cysts, and osteopenia presented to her internist with report of irregular uterine bleeding for the preceding three months, accompanied by complaints of abdominal bloating, night sweats, and constipation. The patient stated she had completed two negative qualitative urine pregnancy tests and had been seen by both gynecology and gastroenterology, with recommendations to start supplemental estrogen for her symptoms and begin additional fiber intake for irritable bowel syndrome, respectively. Despite negative urine beta-hCG, a quantitative serum beta-hCG was obtained and revealed a level greater than 200,000 international units (IU). The patient was referred to gynecologic oncology and an open abdominal hysterectomy with preservation of her ovaries was performed. Histopathologic examination showed a complete hydatiform mole with no evidence of invasion.

Conclusion: The case highlights the importance of clinical judgment in modern medicine, where biochemical methods and imaging modalities have become mainstays in diagnosis. As mentioned, there are ways to reduce the incidence of the hook effect, but with added time and cost. Clinicians need to consider the possibility of the hook effect for instances where the clinical picture points to a disease entity despite negative test results. Delaying diagnoses, as illustrated with GTD, has the potential to cause significant morbidity and mortality.

Introduction

Gestational trophoblastic disease (GTD) encompasses a group of tumors derived from trophoblasts, which normally form the placenta during pregnancy. The spectrum can be split into five major histopathologic categories, including the following: hydatiform moles, invasive moles, choriocarcinomas, placental site trophoblastic tumors, and epithelioid trophoblastic tumors. Diagnosis is aided by the detection of elevated levels of serum human chorionic gonadotropin. Human chorionic gonadotropin (hCG) is a glycoprotein composed of an alpha (α) subunit identical to that of thyroid stimulating hormone (TSH), follicle-stimulating hormone (FSH), and luteinizing hormone (LH). The beta (β) subunit, however, is unique to hCG. Detection of β-hCG is achievable in both urine and serum samples, proving useful for the detection of normal pregnancy and GTD. However, in the presence of very high levels of...
β-hCG, a false negative result may be obtained due to a phenomenon called the “hook effect” or “prozone phenomenon.”

**Case Presentation**

A 49-year-old Caucasian female with past medical history pertinent for deep vein thrombosis, ovarian cysts, and osteopenia presented to her internist with report of irregular uterine bleeding for the preceding three months, accompanied by complaints of abdominal bloating, night sweats, and constipation. The patient stated she had completed two negative qualitative urine pregnancy tests and had been seen by both gynecology and gastroenterology, with recommendations to start supplemental estrogen for her symptoms and begin additional fiber intake for irritable bowel syndrome, respectively.

On examination, she was pale but not ill-appearing. Blood pressure was 157/101, her heart rate was 92 and she was afebrile. Cardiovascular examination was normal. Abdominal examination revealed an enlarged abdomen, from the pubis symphysis to the inferior aspect of the umbilicus. A quantitative serum β-hCG was then obtained and revealed a level greater than 200,000 international units (IU). Interestingly, her TSH was noted to be less than 0.02 with a normal free T4 level of 1.6; however, no symptoms of hyperthyroidism were present. A pelvic ultrasound demonstrated an enlarged uterus measuring 16.6 x 14.9 x 10.6 cm with a solid echogenic area visualized within the uterus measuring 13.4 x 13.3 x 12.4 cm (Figure 1). A CT of the abdomen corroborated these findings.

The patient was referred to gynecologic oncology and an open abdominal hysterectomy with preservation of her ovaries was performed. Histopathologic examination showed a complete hydatiform mole with no evidence of invasion (Figure 2). The patient was also seen by endocrinology in regards to her abnormal thyroid function. She was monitored with serial examinations and her thyroid function normalized within six months postoperatively. Serial β-hCG evaluations also demonstrated normalization of levels within six months showing no clinical evidence of GTD recurrence.

**Discussion**

GTD includes a number of abnormal conditions, all of which arise from the human chorion. There is geographic variance in the prevalence of this disease with more frequent cases in Asia as compared to North America and Europe. Incidence of GTD has been noted to be as low as 66 cases per 100,000 pregnancies in Italy to 1,299 cases per 100,000 in Indonesia. The incidence of choriocarcinoma follows a similar pattern with a higher number of cases identified in Asia (202 cases per 100,000 in China) as compared to Europe and North America (two cases per 100,000 in the U.S.).

GTD is notable for the production of large quantities of β-hCG. Patients with this condition usually present with amenorrhea, frequent vaginal bleeding and increasing abdominal girth. On examination, an enlarged uterus for calculated pregnancy period is identified. Diagnosis should be suspected when levels of β-hCG are elevated in
blood or urine. Extremely high levels of \( \beta \)-hCG, common in GTD, may cause a false negative result in either serum or urine \( \beta \)-hCG testing. This phenomenon is called the hook effect.

Current qualitative \( \beta \)-hCG testing utilizes a sandwich immunoassay. Monoclonal antibodies specific to two different and distant sites on \( \beta \)-hCG are isolated. One of the antibodies is attached to a fixed surface (solid phase antibody) and serves to capture \( \beta \)-hCG. A second antibody directed against a distant site on \( \beta \)-hCG is then added, which sandwiches the antigen. This allows both the detection and quantification of \( \beta \)-hCG. Most of the assays commercially sold are developed to detect \( \beta \)-hCG levels found in pregnancy. In conditions such as GTD where higher amounts of \( \beta \)-hCG are encountered, the solid phase and the tracer antibody is saturated with \( \beta \)-hCG molecules resulting in reduced or absent sandwiching resulting in a false negative test result.

The hook effect is not limited to \( \beta \)-hCG testing and has been demonstrated in many other assays which use a similar sandwich technique. These include prolactin, prostate specific antigen, ferritin, calcitonin, and somatotropin. One of the identified problems with the sandwich assay has been its one-step process. This includes adding both the tracer antibody and antigen to the solid phase antibody together which can result in a falsely low level of the antigen identified. A few methods have been identified to prevent this problem. The first method involves switching a one step process into a two-step process where the antigen is first incubated with solid phase antibody and then washed and only then adding tracer antibody. This method adds extra cost and time to the process. Being a less prevalent disease, a two-step process, as well. The second, more definitive, method is dilution, where the serum is diluted before testing. Although very specific, again, significant cost addition is an issue with this method.

\( \beta \)-hCG, due to its similarity to TSH, has known thyrotropic effects. This has been observed during normal pregnancy as well as gestational trophoblastic disease. Symptomatic hyperthyroidism has been described previously due to this effect but is less common. Most of the patients remain asymptomatic with normalization of enzyme levels after normal delivery of the fetus or treatment of GTD. Our patient did not develop symptomatic hyperthyroidism.

Conclusion

The case highlights the importance of clinical judgment in modern medicine, where biochemical methods often become main stays in diagnosis. As mentioned, there are ways to reduce the incidence of the hook effect, but with added time and cost to increase urine testing sensitivity. Thus, clinicians need to consider the possibility of the hook effect for instances where the clinical picture points to a disease entity despite negative urine test results. Delaying diagnoses, as illustrated with GTD missed with qualitative urine testing, has the potential to cause significant morbidity and mortality.

References


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The Effects of Food Deserts on the Weight Status of South Dakota Children

By Emily Niswanger, MS, RD, LD; Elizabeth Droke, PhD, RD, LN; Suzanne Stluka, MS, RD, LN; Kuo-Liang Chang, PhD

Abstract

Introduction: Childhood obesity continues to be a public health issue in the U.S. Research prior to this study demonstrated that children living on food deserts (FD) had greater weight statuses than children who did not live on FDs. Based on U.S. Department of Agriculture classification, almost half of the state of South Dakota is classified as a food desert, and childhood obesity continues to be an issue in the state. The purpose of this study was to determine if FDs play a role in childhood obesity in South Dakota, more specifically whether South Dakota children who live on FDs or on the border of FDs have greater weight statuses than children who live on non-FDs.

Methods: School height and weight data collected by the South Dakota Department of Health was used to calculate weight status for students in six schools; weight was categorized as underweight, healthy weight, overweight, and obese.

Results: It was discovered that the pair of border-FD areas had the lowest total percentage of students who were classified as obese while the non-FD areas had the highest percentage of students who were classified as obese. The FD areas fell in between the aforementioned areas.

Conclusions: By utilizing this research and identifying precursors for obesity, such as where an individual lives and their access to healthy food, health care leaders and their multidisciplinary team can help facilitate community interventions that target areas most impacted by childhood obesity.

Introduction

Childhood obesity continues to be a public health issue in the U.S. According to the most recent National Health and Nutrition Examination Survey (NHANES), the U.S. saw the prevalence of obesity among 2- to 19-year-olds dramatically increase by 16.9 percent between 1976-1980 and 2009-2010. Racial and ethnic disparities most affected by this increase include non-Hispanic white, Mexican-American and non-Hispanic black boys and girls.

Prevention strategies aimed at decreasing childhood obesity often focus on changing behaviors such as dietary choices and parenting methods. Although these strategies may be effective, it is important to take into consideration that some communities lack access to healthy, affordable food, which can also play a significant role in overall health. Therefore, it is important to assess if where an individual lives plays a role in childhood obesity.

Low-income census tracts with a considerable number or share of residents who have low access to a supermarket or large grocery store are defined as food deserts (FD). Low access is defined in urban areas as greater than one mile from a supermarket or a large grocery store and in rural areas as more than 10 miles from a supermarket or large grocery store. According to the U.S. Department of Agriculture (USDA) Food Desert Locator, in the U.S., there are 13.6 million people living on areas with low-access to a supermarket or large grocery store. In South Dakota, almost half of the state is classified as a FD. Development of a FD is often the result of an area’s small population and/or limited profit for the grocer.
areas, gas stations and convenience stores tend to fill the void of the local grocery store. Issues with buying groceries at a local convenience store include limited food items, higher cost, calorie dense options, and highly processed foods. Individuals with diets that consist of processed foods, especially those high in sugar and sodium, have been shown to have poor health outcomes.

Lacking access to healthy food has been seen as a contributor to childhood obesity. Studies have shown that the consumption of unhealthy, high calorie, low nutrient foods put a child at a greater risk for being overweight, while a greater intake of fruits and vegetables has been associated with a reduced risk of obesity and other health issues. The distance an individual lives from a grocery store or supermarket can also increase or decrease his or her risk of being overweight. Research by Jilcott and colleagues discovered that in urban counties where grocery stores were more available, there was a lower prevalence of obesity when compared with non-urban/rural counties. Also, adolescents who had increased availability to supermarkets had significantly lower weight statuses and were less likely to be overweight than adolescents who had convenience stores more readily available to them. These theories about FDs were used to form the basis of this study.

The purpose of this study was to determine if the weight status of South Dakota children (ages 5 to 18) was associated with them living on FDs, border-FDs, or non-FDs. By identifying precursors for obesity, such as where an individual lives and their access to healthy food, a plan of action can be made by community and state members to help prevent childhood obesity. Whether the solution is building a grocery store or stocking the local convenience store with healthy, affordable food, something will need to be done to prevent further increases in childhood obesity.

It was hypothesized that the weight status of children living on South Dakota FDs would be greater than South Dakota children living on non-FDs. It was also hypothesized that the weight status of children living on border-FDs would be greater than children on non-FD areas, but lower than children who live on FDs. Data suggests that FDs lack access to healthful foods and typically only provide low-nutrient, highly processed foods. As a result, urban counties with a greater availability to large grocery stores have shown a lower prevalence of childhood obesity (14.4 percent) when compared to rural counties (16.5 percent).

Methods
Data from the South Dakota Department of Health (SDDOH) School Height and Weight database, the USDA’s Food Desert Locator, and the U.S. Census Bureau was integrated together for this study. Student height and weight data from schools across South Dakota were used as raw data for this cross-sectional study. The USDA Food Desert Locator, an online tool (www.ers.usda.gov) designed to show where FDs are located across the U.S., was used to categorize schools (See Appendix A). The U.S. Census Bureau’s online database (quickfacts.census.gov) was used to gather additional information about the populations used in this study. The South Dakota State University Institutional Review Board for Human Subjects reviewed and approved the protocol. Review and approval was also obtained from the SDDOH prior to the start of the study.

Contact with the South Dakota Department of Health
The SDDOH provided the 2010-2011 school year height and weight data that was used in this study. Each year the Coordinated School Health Program mails out an information packet to health/physical education teachers and school nurses requesting voluntary submission height and weight data for kindergarten, elementary and high school students.

To assure that data obtained from schools is credible, the SDDOH acquires data collector credentials and training experience along with information about the instruments they used. The above information was obtained for the six schools that were used in this study. In school number 1, two physical education teachers, one with a master’s degree, the other a bachelor’s degree, collected the data. In schools 2, 3, 4, and 5, a registered nurse collected the data. Lastly, school number 6 used the school principal and secretary to collect data. All schools used balance beam scales and wall-mounted measuring boards provided by the SDDOH.

The report then breaks down weight into the following categories: underweight, healthy weight, overweight and obese. Overall findings are also included in the report. The goal of collecting height and weight data is to track childhood obesity and use this information to propose strategies to reverse this trend.

Description of Database
Data collected from the 2010-2011 school year represented
35.2 percent of South Dakota’s students. Students used in this research were selected from 193 schools and 49,146 students, which made up the 2010-2011 database. A request to use the 2010-2011 student height and weight data was submitted to the SDDOH in February and approved in March of 2012. School data, which was de-identified, was obtained and categorized according to location using the USDA’s Food Desert locator and a map of the schools participating that school year (see Appendix B). The Food Desert Locator allows the user to enter an exact address and see whether or not that place is classified as a FD. For the present study, schools were identified as being located on a FD, border-FD, or non-FD. The USDA definitions for rural and urban were also used to classify the schools. Schools in towns with populations less than 2,500 were classified as rural while towns with 2,500 or more people were classified as urban.4

Selection of Schools
Using information from the Food Desert Locator along with data on race, population size, and geographic location (reservation land vs. non-reservation land) three pairs of schools were selected. The first pair of schools was made up of a majority of non-Hispanic, white residents, on border-FDs that also bordered Native American reservations. The border FD schools were on different sides of the state, one in the north and the other in the south. The purpose of comparing two border-FDs to one another was to see if the characteristics of the students in those areas were similar. Characteristics of interest were race and weight status. The reason for including border food deserts in the overall comparison between FDs and non-FDs was to see the affect that living close to a FD had on a child’s weight status.

The second pair of schools, one on a FD the other on a non-FD, consisted mainly of Native Americans on reservation land. The last pair of schools consisted of one FD and one non-FD location with the majority of the population being non-Hispanic, white residents on non-reservation land. School number 1 was the only school located in an area classified by the USDA as urban whereas the remaining five schools are classified as rural with populations less than 2,500. These six schools were intentionally selected to decrease the potential influence of racial background on the findings of this study.

Selection of Children
A total of 1,408 students from six schools were included in this study. Characteristics that encompass the students used in this study include: a) students attending a South Dakota elementary, middle school, or high school; b) students ages 5 to 18; c) males and females; d) students attending one of the six schools defined above; and, e) all ethnic groups. Students were excluded if they were: a) older than age 18 or b) attending a school other than the six identified above. A total of 12 students were excluded from the study because they exceeded 18 years of age.

Abstracting Data
Age, race, gender, and weight status were analyzed to find their frequency for each school. Weight status was obtained using the equation for BMI by dividing the student’s weight in pounds over height in inches divided by height in inches and multiplied by 703 (Weight (lb.) ÷ Stature (in.) ÷ Stature (in.) x 703).

The Centers for Disease Control and Prevention (CDC) recommends that BMI-for-age be used to assess weight status for children ages 2 to 20 and to only use the weight-for-stature charts as an alternative for children ages 2 to 5.12 These charts are age and gender specific and have the curve’s outer limits set at the fifth and 95th percentiles.12 Using this growth chart, students’ BMI was classified into the weight status categories of underweight, healthy weight, overweight and obese based on their age and gender according to the CDC clinical growth charts.15 The CDC categorizes children less than fifth percentile as underweight, fifth to less than 85th percentile as at a healthy weight, 85th to less than 95th percentile as overweight, and greater than or equal to 95th percentile as obese.13

Analysis of the Data
In order to perform statistical analyses, the selected data had to be categorized first by creating and coding variables. These variables included gender, age, race, and weight. The gender (denoted Gender) was coded as a dummy variable (i.e., 1: male; 2: female). The variable age (denoted Age) was coded as an interval variable starting with age 5.5 and ascending by 0.5 up to age 18 (i.e., 5.5, 6, 6.5…18). The variable race (denoted Race) was coded as a categorical variable (i.e., 1: white, not Hispanic; 2: black, not Hispanic; 3: Hispanic; 4: Native American/Alaska Native; 5: Hawaiian/Pacific Islander; 6: Asian, 7: Other race). None of the schools used in this study had students who were classified as Hawaiian/Pacific Islander; therefore, this race was excluded from the results. The
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weight status of sample observations (denoted BMI) was coded as an ordinal variable (i.e., 1: underweight; 2: healthy weight; 3: overweight; 4: obese.) Statistical software Statistical Analysis System (SAS) 9.2 was used to analyze the data. Descriptive statistics were analyzed first using the SAS procedure “proc freq” and “proc means” to examine the basic statistical information for the variables, including mean, standard deviation, and sample distribution. The difference of variables gender, age, race and weight for the three pairs of schools was tested using the non-parametric Kruskal-Wallis test approach by the SAS “PROC NPAR1WAY” procedure. The Wilcoxon option was chosen to detect differences between distributions. The hypothesis was tested using a chi-square test, which indicates that at a confidence interval of 95 percent, if the chi-square value is less than 0.05, the null hypothesis (i.e., the means are the same) should be rejected.

Descriptive Statistics
Various sociodemographic variables for each of the six locations were obtained. Variables taken into account included: income and employment. Table 1 was constructed to examine the relationship between these sociodemographic variables. Table 3 shows a comparison of student weight status in the six schools. These comparisons may help illustrate the type of environment that may put children at additional risk for overweight and obesity.

Results and Discussion
A total of 1,408 student heights and weights were collected by the SDDOH and analyzed for this study. Descriptive characteristics of the communities and subjects are summarized in Table 1. Using the U.S. Census Bureau’s definitions of rural and urban, all of the schools except school number 1 were classified as rural with populations less than 2,500. This is important to consider because nationwide trends have shown obesity to be greater among children living in rural areas (16.5 percent) than urban areas (14.4 percent.). However, based on the six schools used in the present study, this did not seem to transfer over to South Dakota.

<table>
<thead>
<tr>
<th>Table 1. Descriptive Characteristics of Participating Schools on Food Deserts, Non-Food Deserts and the Border of Food Deserts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Desert Category</strong></td>
</tr>
<tr>
<td>School Number</td>
</tr>
<tr>
<td>Population &amp; Income</td>
</tr>
<tr>
<td>2010 Population</td>
</tr>
<tr>
<td>Median Family Income ($)</td>
</tr>
<tr>
<td>Employment (%)</td>
</tr>
<tr>
<td>Employed</td>
</tr>
<tr>
<td>Unemployed</td>
</tr>
<tr>
<td>Students (n)</td>
</tr>
<tr>
<td>Males (%)</td>
</tr>
<tr>
<td>Females (%)</td>
</tr>
<tr>
<td>Age (%)</td>
</tr>
<tr>
<td>5 to &lt;11.5 years</td>
</tr>
<tr>
<td>≥ 11.5-18 years</td>
</tr>
<tr>
<td>Race (%)</td>
</tr>
<tr>
<td>White, non-Hispanic</td>
</tr>
<tr>
<td>Black, non-Hispanic</td>
</tr>
<tr>
<td>Hispanic</td>
</tr>
<tr>
<td>Native American</td>
</tr>
<tr>
<td>Hawaiian/Pacific Islander</td>
</tr>
<tr>
<td>Asian</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

a Border FD = school located on the border of a food desert; FD = school located in a food desert; Non-FD = school located in a non-food desert area.
b Data obtained from U.S. Census Bureau.19
Celebrating Excellence

Outstanding Faculty

Alla Zamulko, MD
Clinical Professor
USD Sanford School of Medicine
Internal Medicine
Sanford Medical Center

Elie Dib, MD
Clinical Professor
USD Sanford School of Medicine
Hematology and Medical Oncology
Sanford Medical Center

Promotion recognizes the significant contributions by faculty and celebrates their accomplishments.

Dr. Alla Zamulko and Dr. Elie Dib were honored for their work in teaching, service and scholarly activity with promotion to Clinical Professor.

Congratulations Dr. Zamulko and Dr. Dib
The median family income for all six schools ranged from $29,554 to $45,625. In South Dakota from 2007 through 2011 the average median family income was $48,010. School number 4 located on a non-FD had the lowest median family income ($29,554) and school 2 a border-FD had the highest median family income ($45,625). The two FD schools, 3 and 5, had the second and third lowest median family incomes of all six schools ($33,625 and $31,250). Research has shown a positive correlation between individuals living in rural FDs and greater socioeconomic disadvantage, including increased poverty rates and diminished educational attainment. Additionally, in 2010, nationwide poverty rates were greater for those living in rural (16.9 percent) versus urban areas (10.8 percent). This connection between poverty and living on a FD could be viewed as a contributor to a family’s ability to access and obtain healthy foods.

The highest unemployment rate was seen in school 4, a non-FD (6.2 percent). In addition, school number 4 had the lowest median family income. The second highest unemployment rate was in school 1, a border FD (5.5) and the third highest rate was in school 5, a FD (4.9 percent). The statewide unemployment rate during this time in rural areas of South Dakota was 4.8 percent while unemployment rates in South Dakota urban areas was 4.6 percent.

The sample size of students was different (p<0.05) among the three pairs of schools due to a difference in total population of the communities. Schools number 1 and 2 had the greatest total student populations followed by schools 3 and 4 then schools 5 and 6. The rurality and geographical disbursement of South Dakota residents made it difficult in this study to choose schools with similar racial make-up and student populations. In terms of the project objective, it was more important to keep the racial make-up of the paired schools similar, thus student populations varied.

### Table 2. Mean Values and Kruskal-Wallis Test Chi-square Comparison Between Schools on Food Deserts, Non-Food Deserts and the Border of Food Deserts for Variables Gender, Race, Age, and Weight Status

<table>
<thead>
<tr>
<th>School Number</th>
<th>Pair 1</th>
<th>Pair 2</th>
<th>Pair 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Chi-square</td>
<td>Mean</td>
</tr>
<tr>
<td>Gender*</td>
<td>1.5</td>
<td>0.2176</td>
<td>1.5</td>
</tr>
<tr>
<td>Race*</td>
<td>1.9</td>
<td>&lt;0.0001*</td>
<td>3.4</td>
</tr>
<tr>
<td>Age*</td>
<td>12.1</td>
<td>&lt;0.0001*</td>
<td>11.6</td>
</tr>
<tr>
<td>Weight Status*</td>
<td>2.6</td>
<td>0.3123</td>
<td>2.8</td>
</tr>
</tbody>
</table>

* 90 percent confidence level; 95 percent confidence level; 99 percent confidence level.

* Coded as a dummy variable (1: male; 2: female).

* Coded as a categorical variable (1: white, not Hispanic; 2: black, not Hispanic; 3: Hispanic; 4: Native American/Alaska Native; 5: Hawaiian/Pacific Islander; 6: Asian; 7: Other race).

* Coded as an interval variable starting with age 5.5 and ascending by 0.5 up to age 18 (i.e., 5.5, 6, 6.5… 18).

* Coded as an ordinal variable (1: underweight; 2: healthy weight; 3: overweight; 4: obese. The ± mean SD was then calculated for each school.

### Table 3. Weight Demographics of Students on Food Deserts, Non-Food Deserts and the Border of Food Deserts

<table>
<thead>
<tr>
<th>Food Desert Category*</th>
<th>Border FD</th>
<th>Border FD</th>
<th>FD</th>
<th>Non-FD</th>
<th>FD</th>
<th>Non-FD</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Number</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Weight Status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>Healthy weight</td>
<td>60</td>
<td>64</td>
<td>49</td>
<td>47</td>
<td>62</td>
<td>43</td>
</tr>
<tr>
<td>Overweight</td>
<td>15</td>
<td>17</td>
<td>19</td>
<td>23</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>Obese</td>
<td>22</td>
<td>17</td>
<td>31</td>
<td>29</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>Mean BMI (kg/m²)</td>
<td>21</td>
<td>19</td>
<td>23</td>
<td>21</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>Weight category*</td>
<td>2.6±0.9</td>
<td>2.5±0.8</td>
<td>2.8±0.9</td>
<td>2.8±0.9</td>
<td>1.9±0.8</td>
<td>2.9±0.9</td>
</tr>
<tr>
<td>Chi-square*</td>
<td>0.312</td>
<td>0.988</td>
<td>0.0001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Border FD = school located on the border of a food desert; FD = school located in a food desert; Non-FD = school located in a non-food desert area.

* Weight status was determined using a student’s BMI and the CDC weight classification. The percentage of students falling into each weight classification was then determined.

* Weight category was determined by coding the weight classifications into: 1 = underweight; 2 = healthy weight; 3 = overweight; and 4 = obese. The ± mean SD was then calculated for each school.

* All of the chi-square values are the result of the Kruskal-Wallis test comparing the 3 pairs of schools.
Student population size may have played an important role in the significance of the results found for weight in schools number 5 and 6 because this pair of schools had the lowest total student population. Small sample size may result in greater variation of results. Using a larger sample size can help to decrease this potential variation. Despite this theory, the sample size used for this study reflected the population of South Dakota very well. When the student population was broken down into gender groups, no significant differences in the number of males and females were found between schools (Tables 1 and 2).

To increase sample size, this study included a range of students from 5 to 18 years of age. The ages of the students were different in all schools: school pairs 1 and 2 (P= .0001); 3 and 4 (P= .0001); and, 5 and 6 (P= .0242) (Tables 1 and 2). A total of 892 students fell into the age range of 5 to 11.5 while the remaining 516 students were ages 12 to 18. Data from the South Dakota School Height and Weight report indicated that the highest rates of childhood obesity were among children ages 12 through 14 years (17.4 percent), second highest in children ages 9 through 11 (16.3 percent), and lowest in 5- through 8-year-olds (13 percent).

The age distribution of students in schools 1 and 2 show that school number 1 had more (P<0.05) students that were greater than or equal to 11.5 to 18 years of age, than school 2. School 1 also had more children who were classified as obese than school 2. Age distribution of students in schools 3 and 4 show that school 3 had an older student population (greater than or equal to 11.5 to 18 years of age) compared with school 4, which had a greater population of younger students. School 3 also had a greater rate of obesity than school 4 (Tables 2 and 3). Lastly, the age distribution of students in schools 5 and 6 show that the ages of students in schools 5 and 6 were very similar, but school 6 had a significantly older student population of greater than or equal to 11.5 to 18 years of age than school 5. School 6 also had more students who were obese than school 5. In all three pairs, the school that had the greatest number of students greater than or equal to the age of 11.5 also had the greatest number of students who were obese. Research from NHANES supports this finding. In 2010, obesity was highest among adolescents ages 12 through 19 at 18.4 percent followed by children ages 6 through 11 at 18 percent.

Based on the original pairing of schools, it was expected that race would not be different among schools. Despite this prediction, race was significantly different within the three pairs of schools as shown in Tables 1 and 2. The original pairing of the six schools was based upon the racial make-up and geographic location of the schools. Schools 1 and 2 and 5 and 6 had populations that consisted predominantly of white, non-Hispanic students. Schools 3 and 4 consisted mainly of Native American/Alaska Native students living on reservation land. In addition, schools 3 and 4 also had the second and third greatest percentages of obese students among all of the schools (Table 3).

This apparent connection between race and obesity in schools 3 and 4 did not come as a surprise. This is due to the fact that the overall obesity rates in South Dakota are greatest among non-Hispanic Native Americans at 39.8 percent compared to Hispanics at 32.2 percent and whites at 28.3 percent. When it comes to obesity in South Dakota children, 26.9 percent of Native Americans are affected compared to 13.2 percent white. For this reason, comparing a predominately Native American student population to a predominately white population would have provided an unfair comparison. It appears that in South Dakota, race may play a larger role in determining a child’s risk for obesity than whether or not they live on a FD or border-FD.

Altogether, the majority of students were classified as having healthy weights and very few students were classified as underweight as seen in Table 3. All schools, except school 5, presented overweight and obesity at 34 percent or higher. Only one pair of schools showed a significant difference in the weights of their students (Tables 2 and 3). School 5, a FD, had fewer (P=0.0001) students that were considered to be overweight or obese when compared with the students in school 6, a non-FD. School 5 had a substantial number of students who were classified as underweight (29 percent) compared to obese (10 percent). This significantly impacted the mean BMI and weight category of the school thus influencing the results obtained. Based on the data available to the researchers, it is unclear why there were a greater percentage of underweight students in school 5. One theory is that the low weight statuses could be related to food insecurity resulting from the low income and high unemployment rates in that area. Further research is warranted. The other two pairs of schools did not show any differences between the weights of their students.

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Appendix A.

Figure 3. South Dakota Food Deserts Displayed by Census Tracts.

Appendix B.

South Dakota Schools Participating In Height & Weight Survey, 2010-2011
combined for the schools, school 6 a non-FD had the greatest percentage of overweight and obesity (57 percent) followed by school 4 a non-FD (52 percent), school 3 a FD (50 percent), school 1 a border-FD (37 percent), school 2 a border-FD (34 percent), and school 5 a FD (10 percent). It was unexpected that the greatest rate of overweight and obesity would be observed in non-FD schools. This could be an outcome of the limited sample size of the study, but does warrant further investigation.

Although the findings obtained from this study were opposite of the predicted hypothesis, these results present some interesting findings. Out of the six schools used in this study, childhood obesity levels were greatest on a non-FD, followed by a FD, and lastly a border-FD. School 5 had a significant number of students who were classified as underweight, but the reasons for this are unknown. Overall, in South Dakota, strong racial differences may overpower the influence of living on a border-FD or in a FD.

Additional research that includes more FD areas may help to clarify the links between childhood obesity and geographic location in South Dakota. A comparison of these findings to future height and weight data collected by the SDDOH may also present interesting trends over time. In addition, by identifying precursors for obesity nationwide, such as location and access to healthy food (FD and non-FD areas), a plan of action can be made by community and state members to help prevent future obesity in children. This will help direct community and state funds to where they are needed the most and will be the most effective.

REFERENCES


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Propionibacterium Acnes Brain Abscess in an Immunocompetent Man in the Absence of Prior Neurosurgery

By Olufunso W. Odunukan, MBBS, MPH; Fares Masannat, MD; J. Jeff Baka, MD

Abstract

Propionibacterium acnes is a rare, but established, cause of intracranial abscesses. We describe a case of P. acnes brain abscess in an immunocompetent man without prior neurosurgery.

A 49-year old man with mild psoriasis presented with a two-week history of gait changes, generalized weakness and a two-day history of headaches, aphasia and confusion. Imaging revealed a left thalamic mass and surgical biopsy suggested a pyogenic abscess. Cultures of biopsy samples of the abscess grew P. acnes alone. MRI and serial neurological exam showed marked clinical improvement with intravenous antibiotics. The significant reduction in the abscess was sustained on MRI obtained at six weeks after completion of antibiotic therapy. In conclusion, P. acnes must be considered as a differential diagnosis in individuals presenting with features suggestive of a brain abscess even in the absence of immunosuppression or previous neurosurgery.

Introduction

Propionibacterium acnes is a rare, but established, cause of intracranial abscesses. It is a rod shaped, gram positive organism that resides in the anaerobic environment of the hair follicle. Similar to coagulase negative staphylococci, P. acnes needs a breach of normal skin in order to initiate infection and the pathogenic potential seems to be magnified by the presence of a foreign body, hence its tendency to complicate intracranial procedures or previous trauma. Diagnosis remains a challenge given the slow growth of the organism and its fastidious requirements for isolation. Here we describe a case of intracerebral P. acnes abscess in an immunocompetent individual with no established risk factors.

Case Report

A 49-year-old right-handed man presented with a two-week history of gait changes, ataxia, chills, and generalized weakness, as well as two days of persistent headaches, aphasia, and increasing confusion. There was no history of facial or body acne but he had a history of psoriasis. He was on a regimen of enalapril and hydrochlorothiazide for hypertension. He had no prior neurosurgical intervention. He had a history of nicotine abuse, but no intravenous drug use. A brain computed tomographic scan at the referral facility had revealed a low density left thalamic mass lesion with significant mass effect (Figure 1). Physical examination at admission was notable for repetitive speech, a right-sided facial droop, marked right upper extremity drift with mild weakness, and dysmetria. His overall dental hygiene was poor, but he had no overt lesions or dental abscesses. He had a raised plaque on his right knee consistent with mild psoriasis. He had profound leukocytosis with a rapid increase in his white cell count within 24 hours from 11,000 per µL to 38,800 per µL, with 91 percent neutrophilic predominance. Contrast enhanced magnetic resonance imaging (MRI) showed a multi-compartmental mass in the left thalamus with vasogenic edema and extension of diffusion-restricted material into the frontal and occipital horns of the left lateral ventricle with mass effect. There was enhancement of the pia in the posterior fossa and suprasellar cistern consistent with meningitis.

He underwent stereotactic biopsy with 4.5 cc of foul smelling purulent material aspirated. Biopsy of the lesion showed predominantly necrotic tissue with an acute inflammatory mixture of lymphocytes, neutrophils, and histiocytes with no evidence of malignancy identified.

Workup included computed tomography of the neck,
a healthy person, this is the first case of an intraparenchymal abscess described in the absence of established risk factors in an immunocompetent individual. It has been suggested that dental hygiene in this patient was poor, he had no identified abscesses. Previous reports of P. acnes infections have described an indolent course with intervals following intracranial operations ranging from 18 months to 10 years. The fairly rapid evolution of the infection in this case is unusual given that the patient was in his usual state of health until two weeks prior to presentation. In patients without neurosurgical procedures, P. acnes abscess has been described in the setting of presumably metastatic multiple lesions. However, extensive imaging studies in our patient did not show any abscesses in the body. A case of P. acnes brain abscess has been reported in the absence of established risk factors in an HIV-positive patient on stable combination antiretroviral therapy. Our patient did not have any evidence of immunosuppression. Even though he had a history of mild psoriasis, he had never been on immune suppressing agents. Although he had no signs of acne vulgaris, he had one active psoriasis plaque on his knee at the time of presentation. This may have been a potential source of his infection as psoriasis and other skin conditions have been associated with bacteremia and invasive bacterial infections.

The diagnosis of P. acnes remains a challenge and it is not often identified because of its slow growth with incubation periods ranging from two to nine days with a median of four days. 16S rRNA gene sequencing has been suggested to be a useful alternative method for rapid and timely detection and can be useful in combination with conventional methods particularly with prior empiric antibiotic therapy. P. acnes is potentially curable as the organism has been reported to be highly susceptible to penicillins, cephalosporins, clindamycin, and vancomycin, with universal resistance to metronidazole noted. As in this case, commencement of broad spectrum antibiotics just prior to biopsy increases the potential for partial sterilization of the abscess. The positive response to antibiotic therapy mirrors the natural history previously described.

In conclusion, our case demonstrates the possibility of a P. acnes intracerebral infection with a short latency to presentation in an immunocompetent patient without a previous neurosurgical procedure.

## Discussion

P. acnes brain abscesses are rare and most occurrences have been in the setting of previous neurosurgical intervention or trauma. This has been largely attributed to the presence of the organism as part of the normal flora of the scalp hair follicle, implicating direct seeding as the route of spread. Although de novo acnes meningitis has been reported in the absence of unusual infections, it was felt that he was unlikely to have an underlying congenital immunodeficiency. An IgG level was not checked.

He was empirically treated with a regimen of intravenous meropenem and vancomycin and transitioned to cefepime to complete a six-week course of antibiotic therapy. Metronidazole was added to cover anaerobes given the possibility that antibiotic administration prior to biopsy may have resulted in a sterile abscess.

Repeat MRI imaging two weeks after initiation of antibiotics demonstrated a positive response to therapy (Figure 2). The primary abscess was much smaller and the contiguous lobulations were less conspicuous. There was also interval resolution of the associated edema. At the time of dismissal from rehab three weeks after admission, his presenting features had resolved with only some mild residual expressive aphasia. Followup MRI at six weeks demonstrated near resolution of the abscess (Figure 3).

## 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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Mitral Stenosis Presenting as Asthma

By Shenjing Li, MD; Aiham Jbeli, MD; Maria Stys, MD; and Adam Stys, MD

Abstract
Although wheezing is one of the most common symptoms and physical findings in asthma, other causes of wheezing should be kept in mind: vocal cord dysfunction, postnasal drip syndrome, chronic obstructive pulmonary disease, bronchiectasis, and non-pulmonary diseases, like heart failure and pulmonary edema. Here, we present a case of severe mitral stenosis with pulmonary edema treated for resistant asthma. If asthma is difficult to control, other etiologies of wheezing, including cardiac disease, should be taken into consideration during diagnosis.

Introduction
Mitral stenosis (MS) results from the thickening and immobility of mitral valve leaflets, causing obstruction of blood flow from the left atrium to the left ventricle. An increase in left atrial and pulmonary vasculature creates pressure on the right side of the heart. Acquired MS is most frequently caused by rheumatic heart disease. Occasionally, infective endocarditis, severe calcification of the mitral annulus, and congenital MS may present in the absence of rheumatic involvement. MS is prevalent in developing nations where rheumatic fever is common. In developed countries, MS is rare because of effective treatment and prevention. This case report focuses on the pathophysiology, clinical presentation, physical examination, echocardiography, and management of MS.

Case Report
A 59-year-old previously healthy female initially presented to the acute care clinic for worsening shortness of breath on exertion, wheezing, and cough for a month. Upon examination, her vital signs included a temperature of 36 degrees Celsius, blood pressure of 128/86 mmHg, heart rate of 89 beats/min, and respiratory rate of 16 per min. She had normal S1 and S2 without murmur, and the positive physical finding was diffuse wheezing. After albuterol was given, improvement in symptoms was noted. Pulmonary function testing showed some features consistent with asthma. She had a positive methacholine challenge test with marked decline in forced expiratory volume in 1 s (21 percent) and partial recovery after albuterol bronchodilation; chest X-ray was negative for cardiovascular changes.

In the following two years, the patient visited acute care and office multiple times for cough, wheezing, and shortness of breath, which were treated as bronchitis and asthma exacerbations. Chest X-ray conducted during the last episode showed diffuse interstitial pulmonary edema and trace pleural effusion. A transthoracic echocardiogram was ordered and showed moderate aortic stenosis, severe MS (Figure 1) with a mitral valve area of 1.26 cm².
and diastolic pressure half-time (dPHT) of 175 ms (Figure 2), moderate left atrial enlargement, severe pulmonary hypertension with a right ventricular systolic pressure of 75 mmHg, and preserved ejection fraction. Physical examination revealed expiratory wheezing, aortic systolic murmur, and mitral diastolic murmur. Transesophageal echocardiogram further revealed severe MS (Figure 3) with a mean transmitral gradient of 15 mmHg and moderate aortic stenosis. The patient underwent mitral and aortic valve replacement with bioprosthetic valves (Figure 4). Post-surgery, the patient developed atrial fibrillation, which was treated by rate control with a calcium channel blocker and anticoagulation with warfarin. Her symptoms of wheezing and dyspnea subsided after surgery.

Discussion

In a majority of cases, MS is caused by rheumatic heart disease. MS is quite rare in Americans which may delay its diagnosis, as in the current case. Acute rheumatic fever is caused by group A streptococcus infection. The streptococcal M protein is a target of T cells that shares epitopes with cardiac myosin and laminin in the valvular basement membrane. In the acute phase of rheumatic fever, carditis can occur and progress to rheumatic heart disease. The cross-reactivity between the M antigen and valve tissue results in valvular inflammation without evidence of active infection of the leaflets. All four valves can be damaged by rheumatic fever; however, the mitral valve is almost always damaged because greater stress on mitral leaflets causes more severe inflammation. In the acute phase, inflammation can cause leaflet retraction which results in acute mitral regurgitation. If recurrent rheumatic fever occurs, the inflammatory process can fuse the leaflet commissures and shorten and fuse chordae tendineae resulting in MS.

A normal mitral area is about 4 to 5 cm. Throughout most of the diastole, the pressure in the left atrium and ventricle are equal. As the mitral valve progressively narrows in MS, the hemodynamic consequence is an increased pressure gradient between the left atrium and ventricle in the diastole. Backward pressure from the left atrium causes pulmonary hypertension and eventually leads to right-sided heart failure. Pulmonary hypertension in MS is frequently reversible after relieving mechanical stenosis of the mitral valve.

Patients with MS usually remain asymptomatic and slowly progress until the valve area is severely stenotic.
Situations, like exertion and stress, that increase cardiac output can markedly increase the transmirtal pressure gradient and cause symptoms. Patients may present with intermittent symptoms, such as exertional dyspnea, wheezing, and coughing, like our patient. Some may present with secondary complications, including atrial fibrillation and embolic events. In some cases, an enlarged left atrium may impinge on the left recurrent laryngeal nerve causing Orthner syndrome.

A physical examination can be diagnostic for MS. Opening snap (OS) and diastolic murmur are two characteristic findings of MS. The OS results from an abrupt halt in leaflet motion in the early diastole. In general, the shorter the A2-OS interval, the more severe the MS. Diastolic murmur is a low-pitched diastolic rumble that does not correlate with the severity of the stenosis. However, physical findings are usually subtle, and murmurs may be difficult to appreciate, particularly with rapid atrial fibrillation. As a result, MS is largely diagnosed based on echocardiography. Transesophageal echocardiography reveals the degree of calcification and thickening of mitral leaflets, reduced motion during diastole, and a “doming” of the mitral valve by commissural fusion (typical “hockey stick” appearance, Figure 1). Doppler can measure the mean transvalvular gradient, dPHT, and pulmonary artery systolic pressure. In addition, chamber size and left ventricular systolic function can be assessed. All echocardiogram measurements should be taken into account when deciding the clinical severity of MS. Chest X-ray in typical MS reveals evidence of enlargement of the left atrium, calcification of the mitral annulus, and pulmonary vascular congestion. In addition, cardiac catheterization can directly measure the transmirtal pressure gradient and confirm the severity of MS. The 2014 American Heart Association/American College of Cardiology Valvular Heart Disease Guideline defines severe MS as a planimetered mitral valve area less than or equal to 1.5 cm² and dPHT greater than or equal to 150 ms with severe left atrial enlargement; a mitral valve area less than or equal to 1.0 cm² and dPHT greater than or equal to 220 ms indicate very severe stenosis.

For asymptomatic patients with mild MS (mitral valve area greater than 1.5 cm²), yearly follow-up with echocardiography is recommended because the average rate of decrease in valve area is about 0.09 cm² per year. In this situation, secondary prevention of rheumatic fever is indicated to prevent repeated attacks and may delay the progression of MS. Oral anticoagulation is strongly recommended for MS patients that have developed atrial fibrillation, left atrial thrombus, or had a prior embolic event. Warfarin should be started and continued indefinitely due to the high risk of stroke (as high as 15 percent per year).

Percutaneous mitral balloon commissurotomy is recommended as a Class I treatment for symptomatic severe MS patients without left atrial thrombus or moderate-to-severe mitral regurgitation. A favorable valve morphology, in which the valve is mobile, relatively thin, and free of calcium, is essential to this type of intervention and can be assessed by the Wilkins score. In severe MS patients with severe symptoms (e.g., New York Heart Association classes III-IV) who are not at high risk for surgery and percutaneous mitral balloon commissurotomy failure, mitral valve surgery is indicated, including repair, commissurotomy or replacement. Because MS is a slow, progressive disease and does not affect the left ventricle, surgery should be performed on severely symptomatic patients.

MS is diagnosed based on medical history, physical examination, and echocardiography. Early diagnosis may offer more treatment options and improve clinical outcome. In our case, the patient may have had some features of asthma according to a positive pulmonary function test (PFT) performed two years ago. However, at that time, her MS could have been moderately severe, and pulmonary edema only occurred with exertion or stress but did not influence PFT. As MS progresses, the mitral area persistently decreases. Pulmonary edema caused by severe MS may mimic asthma exacerbation, thereby confounding an accurate diagnosis and delaying MS treatment. Therefore, MS should be kept on the list of differential diagnoses when the clinical presentation does not fit that of common diseases.

REFERENCES


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Introduction
Despite their importance, coverage rates for adolescent vaccinations consistently lag behind those of other childhood vaccinations. In this article pertussis, meningococcal disease and human papillomavirus (HPV) infections as well as the three recommended vaccines for adolescents are described in brief, to help primary care providers better understand the need for and barriers to adolescent immunization and ensure that all eligible adolescents receive their vaccinations.

Pertussis
Pertussis is a highly contagious respiratory illness caused by the bacterium *Bordetella pertussis*. The disease typically progresses through three stages of illness (Figure 1). The disease is contagious from the time of onset to three weeks after the start of the cough.

In 2014, the state health department in South Dakota released an alert that pertussis cases were on the rise. Figure 2 displays the number of cases in 2014 relative to the five-year median. There were 107 cases of pertussis in the state of South Dakota in 2014 compared to the 67 cases reported in 2013.

Analysts suspect the actual numbers of pertussis cases are greater than those reported. This is partly due to the fact...
that the presenting signs and symptoms of pertussis can be mistaken for a viral upper respiratory illness. The health department speculates that the current outbreak is because parents are not keeping their children up to date on their immunizations.

The DTaP vaccine is routinely administered at 2, 4 and 6 months of age, with booster doses at 15 to 18 months and 4 to 6 years of age. Because immunity wanes over a 5- to 10-year period, it is recommended that children 11 to 12 years of age receive a Tdap booster dose. This has been the recommendation from the Advisory Committee for Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) since 2005. If Tdap is not administered at 11 to 12 years of age, it should be given as soon as teens present to the office, as this population is known to make fewer health care visits. The CDC conducts a yearly National Immunization Survey (NIS)-Teen to estimate vaccination coverage from a sample of teenagers ages 13 to 17 years old. As shown in Figure 3, Tdap vaccination rates have improved steadily from 2006 to 86 percent in 2013.

Despite this high vaccination rate, pertussis remains inadequately controlled. As of Dec. 31, 2014, there were 28,660 cases of pertussis reported to CDC during 2014, and this number is expected to increase as case counts are reconciled. This represents an 18 percent increase compared to the provisional numbers that were reported at the same time in 2013. The final case count in 2013 was 28,639.

One reason for continued outbreaks despite high vaccination rates could be related to lack of an approved vaccine for infants less than 2 months of age. The CDC guidelines stress Tdap vaccination at 27 to 36 weeks gestation during every pregnancy. This allows for passive antibody protection during the critical time before the first DTap is administered at 2 months of age. Newborns are at a higher risk of complications from pertussis because of their smaller airway and immature immune system. As one in four pregnancies occur in teenagers 15 to 17 years of age, it is important to improve vaccination rates in teenagers. ACIP also recommends “cocooning” infants by having those in close contact (including adolescents and adults) receive the Tdap vaccine.

Some of the inadequate control of pertussis may also be related to vaccine administration errors. The National Vaccine Error Reporting Program (VERP) reported in November 2013 that Tdap administration errors accounted for a significant number of all vaccine reported errors related to vaccines (8 percent). The reasons given for reported errors were similar vaccine abbreviations, products being stored near each other, and similar generic names. For example, Td was reported as being given rather than Tdap. Appropriate safety measures need to be adopted to avoid such vaccine delivery errors.

Antibiotics effectively treat pertussis only during the catarrhal stage, when the diagnosis is often missed, leading many patients to transmit the disease unknowingly.
Thus, prevention is key in eliminating future pertussis outbreaks. Continued compliance with Tdap administration to all eligible adolescents, eliminating vaccination administration errors, vaccinating pregnant patients during each pregnancy, and those in contact with newborns will help in this effort. NIS-Teen has shown progress in improving immunization rates for teenagers, but the CDC national outbreak trends and current data from South Dakota indicate that there is still room for improvement.

**Meningococcal Disease**

Meningococcal disease refers to an infectious process caused by *Neisseria meningitidis* that infects persons of all ages, with a persistent peak in incidence among adolescents. *N. meningitidis* is an aerobic, Gram negative diplococcus that is spread by aerosol droplets or secretions. This pathogen is a leading cause of bacterial meningitis and sepsis in the U.S. and is also a lesser cause of pneumonia, arthritis, otitis media, and epiglottitis, as shown in Figure 4. Meningococcal disease can affect persons of all ages, with highest predominance among children under 4 years of age. *N. meningitidis* caused around 171,000 deaths worldwide in 2000, being most prevalent in the sub-Saharan desert in Africa. Although meningococcal disease is rare in the U.S., the severity of the illness justifies the need for vaccinations. The case fatality rate of invasive meningococcal disease is 9 to 12 percent despite antibiotic therapy. Meningococcemia has a fatality rate up to 40 percent, with up to 20 percent of persons who survive a serious infection experiencing permanent sequelae such as hearing loss, neurologic damage, or loss of a limb. This is one of the most rapidly progressive and severe illnesses, causing children to become critically ill in a matter of hours from onset of symptoms, potentially leading to coma or death.

The life threatening illnesses caused by meningococcus are sepsis and meningitis. With the onset of meningococcal sepsis, symptoms such as fever with a distinct purpuric rash, quickly leading to hypotension, shock, and multiorgan failure can develop (Figure 5). In about 50 percent of patients with bacteremia, the organism will cross the blood brain barrier and cause meningitis. Meningitis can present with fever, headache, neck stiffness, nausea, vomiting, photophobia, and altered mental status.

There are 13 serogroups of *N. meningitidis*, five of which, A, B, C, Y, and W-135, are pathogenic to humans. In the U.S., serotypes C, Y, and W-135 are the major causes of
meningococcal disease in children over 11 years of age. The rates of meningococcal disease by age group are presented in Figure 6.

There has been a peak of incidence in young adults 18 to 21 years of age, despite routine vaccination. Known risk factors for this invasive disease include persons with terminal complement pathway deficiency, asplenia, and genetic risk factors. Other risk factors such as household exposure, overcrowding, and active and passive smoking, leave adolescents more vulnerable due to social activities and living arrangements. This may be due to living in college dormitories, military barracks, intimate kissing contacts, and cigarette and marijuana smoking. This concept led many colleges to enforce meningococcal vaccination for all incoming freshmen.14

There are currently two types of multivalent meningococcal vaccines: MPSV4 and MCV4. MPSV4 is a polysaccharide vaccine licensed for use in patients older than 2 years of age. The duration of immunity induced by MPSV4 is limited, therefore, MCV4 vaccines are preferred for use in children and adolescents. MCV4 is a conjugate vaccine and there are currently two of these licensed in the U.S.: Menactra and M enveo. MCV4 vaccines are recommended for persons age 11 to 12 years with a booster vaccine given at 16 years of age.12 The rationale for giving the first vaccine at 11 to 12 years of age was 1) more patients this age would attend preventive care visits, 2) to strengthen the pre-adolescent vaccination platform, and 3) the vaccine was expected to continue to protect adolescents during the entire risk period. Studies later indicated that there may not be more than five years of protection with the vaccination, thus a booster vaccination was recommended at age 16. This provides greater protection for the full duration of adolescence in individuals who carry an increased risk of infection.15 Recent data show that vaccine coverage is improving with the new booster vaccination given to 16-year-old adolescents, resulting in increased direct and indirect protection.16 All of these vaccines protect against serotypes A, C, Y, and W-135, which cover the main serotypes responsible for adolescent meningococcal disease. By using this approach of a quadrivalent vaccination, there is broadened serogroup protection, as well as maximal herd immunity by targeting the high risk age group.16

Two new meningococcal group B vaccines have recently been licensed for use in adolescents and young adults in the U.S. Trumenba and Bexsero are indicated for active immunization to prevent invasive disease caused by Neisseria meningitidis serogroup B in individuals 10 through 25 years of age.17,18 The ACIP has made the following provisional recommendations for the use of these two new vaccines in children and adolescents:19

Eligible Groups
- Children aged 10 through 18 years at increased risk for meningococcal disease attributable to serogroup B, including:
  - Children who have persistent complement component deficiencies (including inherited or chronic deficiencies in C3, C5-C9, properdin, factor H, or factor D or taking eculizumab [Soliris]);
  - Children who have anatomic or functional asplenia, including sickle cell disease; and
  - Children identified to be at increased risk because of a meningococcal disease outbreak attributable to serogroup B.

See Table 1 for recommended vaccination schedule and intervals.

Although the incidence of meningococcal disease has decreased since 2000, there has been a persistent peak in this disease among older adolescents. This peak has continued, despite routine vaccinations beginning in 2005. In 2013, the vaccination rate was 78.1 percent for 13- to 15 year-olds in the U.S. The vaccination rate has improved, but efforts need to continue to work towards the goal of 90 percent coverage.14

HPV
Human papillomavirus is the most common sexually transmitted infection in the U.S. More than 100 genotypes of HPV are known, and more than 40 genotypes can infect the genital area of men and women. There are 15 HPV genotypes implicated in the etiology of cervical cancer (16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, 73 and 82).20 HPV s are small, circular, non-enveloped, double-stranded DNA viruses. The basal epithelium is infected and the HPV DNA in many cervical cancers becomes integrated into the host chromosome. The E6 and E7 genes of HPV work to synergistically deregulate cell cycle controls through a variety of mechanisms.21

Epidemiology
According to the CDC, there are approximately 79 million Americans currently infected with HPV, and about 14 million people newly infected each year. Approximately 500,000 women are affected by cervical cancer worldwide each year and cervical cancer causes more than 270,000 deaths annually.22 Cervical cancer is the third most common cancer in women behind breast...
and lung cancer. Ninety-one percent of cervical cancers are associated with the HPV genotypes 16, 18, 31, 33, 35, 45, 52 and 58, with 16 and 18 causing 70 percent of cervical cancers. HPV genotypes 6 and 11 cause 90 percent of genital warts. Most high-risk HPV infections are asymptomatic and resolve in one to two years with no intervention. At any given time, 42.5 percent of women have genital HPV infections, while less than 7 percent of adults have oral HPV infections. HPV genotype 16 causes 85 percent of anal cancers and about half of the cancers of the oropharynx. Over the last 20 years there has been an increase in oropharyngeal cancer especially in young men and it is estimated that in 2020 HPV will cause more oropharyngeal cancers than cervical cancers in the U.S. HPV 16 and 18 have been found to cause close to half of vaginal, vulvar and penile cancers.

Transmission
HPV is spread through direct mucosal contact during vaginal, anal and oral sex. There are factors that increase the risk of developing cancer following a high-risk HPV infection including: smoking, immune deficiency, long-term oral contraceptive use, poor oral hygiene and chronic inflammation.

Prevention
The most reliable way to prevent HPV infection is to avoid any direct oral, anal or genital contact with another person, which is impractical. Condoms that are used correctly and consistently do reduce the transmission of HPV, but not to the areas that are not covered by the condom. There are currently three vaccines approved for the prevention of HPV in the U.S. In 2006, a quadrivalent vaccine that targets HPV types 6, 11, 16 and 18 was introduced. In girls that have not been previously exposed to HPV, there is a 98 percent protection rate by the quadrivalent vaccine. It is 44 percent successful in women who have recently been exposed to HPV, there is a 98 percent protection rate by the quadrivalent vaccine. It is 44 percent successful in women who have recently been exposed to HPV types 16 and 18. In 2009, a bivalent vaccine was approved for HPV types 16 and 18, and in 2014, a nonavalent vaccine was approved for HPV types 6,11,16,18,31,33,45,52,58.

In 2013 NIS-Teen reported that 57 percent of 13- to 17-year-old females received at least one dose, but only 38 percent received all three recommended doses in the U.S. In South Dakota, 56 percent of adolescents received one dose of the HPV vaccine, and only 43 percent completed the 3-dose course. HPV is by far the vaccine with the lowest completion rate among adolescents. Even if only one dose is received, it may be 100 percent effective. The impact of HPV vaccination in reducing high-grade cervical lesions has already been reported. Other factors that could contribute to the reduction of vaccine type HPV are herd immunity, high effectiveness with less than a complete 3-dose series and/or changes in sexual behavior not measured. Currently neither vaccine is approved for the prevention of penile or oropharyngeal cancer. Adverse events reported after HPV4 administration are shown in Figure 7.

Treatment
For most HPV-associated diseases, treatment is painful, expensive and may not lead to cure – another reason why it is important to encourage vaccination to prevent HPV infections. According to the 2013 NIS-Teen, if the first dose of the HPV vaccine was administered during the 11- to 13-year-old well child visit, the rate of HPV vaccination would be 91.3 percent. NIS-teen also reported that there was a missed opportunity in 83.7 percent of adolescents who did not receive the HPV vaccine, but did

![Figure 7. Number of Serious and Nonserious Reports of Adverse Events After Administration of HPV4 vaccine in females, by year – Vaccine Adverse Event Reporting System, U.S., June 2006-March 2013](image)

### Table 1. Recommended Vaccination Schedule and Intervals

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Vaccine Recommendations</th>
<th>Routine</th>
<th>Dosing Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-18 years</td>
<td>MenB (Bexsero, Novartis)</td>
<td>High-risk only</td>
<td>2 doses, at least one month apart (0 and 1-6 month schedule)</td>
</tr>
<tr>
<td>10-18 years</td>
<td>MenB (Trumenba, Pfizer)</td>
<td>High-risk only</td>
<td>3 doses (0, 2, and 6 month schedule)</td>
</tr>
</tbody>
</table>
receive at least one other vaccine at that visit. The most common reason why the teen did not receive the HPV vaccine was due to the lack of knowledge (less than 30 percent). Other reasons included the belief that the vaccine was not needed or necessary, vaccine was not recommended, safety concerns/side effects and child not being sexually active.

Summary
Achieving high rates of vaccination among adolescents remains a challenge. Tdap vaccination rates in teenagers have improved significantly in recent years, but pertussis outbreaks continue to occur, indicating a need for continued vigilance in vaccinating all eligible adolescents. While meningococcal disease has waned in incidence in the U.S., its peak in adolescents and the associated morbidity and mortality in this population warrant ongoing focus on vaccinating teenagers. Although HPV vaccination rates are slowly improving, much work remains to be done in improving these rates in adolescents. Primary care providers should pursue every opportunity to vaccinate their adolescent patients to keep them and the community safe from these infectious diseases.

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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Over the next several years, many patents for branded insulins will expire, and as a result, new insulins products, including concentrated insulins and ultra-long acting insulins, have been developed. The first patent that has expired is insulin glargine (Lantus), followed by insulin detemir (Levemir). Although concentrated insulins are considered advancing technology in diabetes treatment, they also cause concern. In the past, many dosing errors occurred due to multiple available insulin concentrations (U40, U80, U100, and U500), and in 1972, U40 and U80 were discontinued. Ultra-long acting insulins also pose concern due to the unfamiliarity with the long duration of action. As with all new agents, new insulins should be used in carefully selected and properly educated patients to provide the most benefit.

The goal of insulin therapy is to mimic normal insulin secretion in order to maintain glycemic control as seen in nondiabetic patients. Type 1 diabetic patients require insulin from the time of diagnosis, but patients with type 2 diabetes (T2DM) may not need immediate insulin therapy. Rather, lifestyle modifications and metformin are the preferred initial interventions to manage T2DM. Insulin can be considered in T2DM patients with significant symptoms, elevated blood glucose or glycated hemoglobin (A1C) levels despite optimized therapy with non-insulin based regimens. Diabetes is a progressive disease due to continuous loss of pancreatic β-cell function, and insulin therapy is eventually required for most T2DM patients.

Once daily basal insulin is the natural first step in insulin initiation in T2DM because of convenient administration, easy dose adjustments, and low risk of hypoglycemia. Insulin pen devices have made insulin administration even more convenient, decreasing dosing errors, and increasing adherence from ease of use. The ideal basal insulin should have a fairly steady concentration of the drug over time with no significant peak to minimize the hypoglycemia risk. In addition, a duration of action of at least 24 hours for once daily dosing and minimal interpatient variability for a predictable glucose lowering effect is desirable.

The first long acting insulin, insulin glargine 100 units/mL, became available in 2000. With a duration of action lasting 24 hours, it has a mostly stable concentration over time with an unpronounced peak drug concentration between eight to 12 hours. Insulin detemir 100 units/mL, the second long acting insulin, became available in 2005. Insulin detemir 100 units/mL is similar to insulin glargine 100 units/mL, also showing a relatively flat concentration over time with an unpronounced peak between four to seven hours. The exact duration of action is unclear but ranges from 17.5 to 24 hours, thus some patients may require twice daily dosing. Both insulins are available in vials and pens.

Due to the expiring patents on many branded insulins, manufacturers have developed competing agents. The first new agent, insulin glargine 300 units/mL (Toujeo), was approved by the Food and Drug Administration (FDA) in early 2015. Insulin glargine 300 units/mL is a concentrated form of insulin glargine 100 units/mL, delivering the same number of insulin units in a third of the volume. The concentrated formulation and smaller surface area of the dose changes the pharmacokinetic profile, slowing the absorption and prolonging the duration of action to greater than 24 hours. Insulin glargine 300 units/mL showed similar A1C reduction to insulin glargine 100 units/mL, but insulin glargine 300 units/mL may cause less hypoglycemia. The concentrated formulation raises concern for dosing errors, but insulin glargine 300 units/mL is only available as a 1.5 mL pen device. The pen dose window shows the selected number of insulin units, adjusting the volume accordingly, thus no conversion is needed. Each disposable pen contains 450 units and should be discarded 28 days after opening. Insulin naïve T2DM patients should be started at 0.2 units per kilogram of body weight once daily with subsequent dose adjustments. If replacing twice daily NPH insulin, insulin glargine 300
units/mL should be started at 80 percent of the current total daily dose of NPH. If switching from other basal insulins, insulin glargine 300 units/mL can be substituted at a unit-per-unit ratio. When changing from insulin glargine 100 units/mL to insulin glargine 300 units/mL, a dose increase of 10 to 15 percent may be needed to maintain glycemic control.1,3

With FDA approval in September 2015, insulin degludec (Tresiba) is the first ultra-long acting insulin available in the U.S. Insulin degludec is coined as the “Sunday-sleep-in insulin”6 because of the greater than 42-hour duration of action and no significant peak concentration. The half-life of insulin degludec is approximately 25 hours, mimicking ideal basal insulin properties. Similarly timed once daily doses are preferred, but flexible dose timing is an option provided a minimum of eight hours between doses has elapsed. This flexible dosing was tested by giving insulin degludec at intervals of eight to 40 hours, which did not increase adverse events or decrease efficacy. Despite its long duration of action, every other day dosing did not show adequate glycemic control and should be avoided. Insulin degludec is available as 3 mL insulin pens at concentrations of 100 units/mL and 200 units/mL (300 units and 600 units per pen, respectively). No conversion is necessary because the pen dose window shows the number of insulin units selected. Each disposable pen should be discarded 56 days after opening. Of note, both concentrations come in similar packaging and design, and could potentially cause confusion. The recommended dose in insulin naïve T2DM patients is 10 units daily. If converting to insulin degludec from long or intermediate-acting insulin, the same total daily dose can be initiated with no adjustments.7,8

The first insulin “follow-on,” Basaglar (insulin glargine), was approved by the FDA in December 2015. Basaglar contains the same amino acid sequence that is found in Lantus (insulin glargine). It is considered a biosimilar in other countries, but labeled as a follow-on product because there is not a “reference product” for biosimilar products in the U.S. Basaglar was approved through an abbreviated approval process and utilized information from Lantus, along with Basaglar specific data, to establish safety and efficacy. Basaglar should be available by the end of 2016, but the cost, and potential cost savings, is unknown.9

With the development of novel insulins, health care providers have a larger array of insulins than ever before to treat hyperglycemia in diabetic patients. New options include ultra-long acting and concentrated insulins. Biosimilar-type insulins are also on the horizon, potentially decreasing costs for patients. Although many patients may benefit from novel insulins, the risks must also be weighed before changing therapy.
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Greetings and a belated Happy New Year to my esteemed colleagues throughout this great state. I am writing from an ideal (indoor) viewing point of the South Dakota Capitol landscape, watching flocks of geese circling with snow-covered bluffs in the distance and feeling more comfortable than I have in several months. I am thrilled to have the privilege of maintaining this article editorship and humbled by the kind/supportive words from many of you. With the recent sale of DAKOTACARE to Avera Health (effective Jan. 1, 2016) I felt it timely and necessary to apprise you of changes (if any) impacting you and your practice this year. I guarantee you this will be one of my shorter articles.

Although this may surprise many of you, very little has changed within our Medical Management Department in the last few months. Although some staffing changes occurred, all key areas of Care Coordination processes for our membership; Utilization Review, Case Management, Population Health (AKA, Disease Management), Wellness, and Pharmacy Services continue to operate as they did throughout the last year. My role may evolve, but my primary Chief Medical Officer responsibilities remain unchanged. Associate Medical Directors Dr. Mike Pekas and Dr. Jim Engelbrecht continue to assist me/us on a part-time basis. Their wisdom, patience, and support (especially to me) have been invaluable during this recent transition period. Gentlemen, thank you!

You and your office staff shouldn’t see appreciable change by DAKOTACARE: medical and pharmacy oversight requirements all remain in force; physician oversight committees, including Clinical Oversight, Pharmacy & Therapeutics, and Physician Advisory (PAC) Committee remain intact with continued broad provider participation throughout all health systems and independents; appeals/grievances will be handled as professionally and impartial as always. I have been in regular communication with senior leadership (executive and physician) from our new ownership and trust the words I have often heard which are reflected in this article’s title, “business as usual.” With the assistance from many of you we have built a very good commercial health insurance product. The financial problems we encountered from our Health Insurance Exchange membership in 2015 was of no fault to our operational processes, but fully reflective of the extreme challenges to a plan such as ours to remain viable under the ever-changing ACA rules.

The only foreseeable change is that we are planning to move our medical coverage policy guidelines from MCG (Hearst Corporation) to Interqual (McKesson) by early next month, to better align with evidence-based guidelines used by most, if not all, providers/payers in this region. From the analysis we’ve conducted no major approval criteria discrepancies should occur. If after March 1 you notice anything, please let us know. We have customized 100+ medical policies in the past and it’s possible some may not seamlessly transfer during this transition.

I look forward to seeing you around the state this year as I work with Barb Smith, Scott Jamison (Senior Director of Provider Services) and Chad Roggow (Director of Value-Based Reimbursement) to meet with various provider/physician groups and provide evidence-based insurance products to those businesses and individuals in your communities. We could use your help in continuing to promote DAKOTACARE as a company which works closely with physicians, for the benefit of their patients. As always, feel free to contact me directly with any questions at paul.amundson@dakotacare.com or 605.274.3155.

OK, a little wordy still, but I’m trying. Take care, stay warm and healthy!

“The report of my death was an exaggeration.” – Mark Twain, 1897
Sepsis is one of the top ten most common principal causes for hospitalizations today. Due to mortality rates ranging from 16 to 49 percent (according to the 2012 Surviving Sepsis Campaign International Guidelines), the Centers for Medicare & Medicaid Services (CMS) found sepsis to be an important measure to include in the most recent IPPS Final Rule for Fiscal Year 2017 payment determinations. Beginning with Oct. 1, 2015, discharges, the Inpatient Quality Reporting program started requiring data collection of the Severe Sepsis and Septic Shock: Management Bundle Measure (NQF #0500).

The sepsis mortality rate is more than eight times higher than mortality rates among patients admitted for other conditions. According to the Agency for Healthcare Research and Quality (AHRQ), from 1993 to 2009, sepsis-related hospital stays increased by 153 percent, with an average annual increase of 6 percent. Reduced mortality rates have been achieved through the implementation of a bundle of interventions that address process of care for sepsis. In 2009, there were 1,665,400 patients in hospitals diagnosed with sepsis and 258,000 deaths from sepsis (a mortality rate of 16 percent).

The Severe Sepsis and Septic Shock: Management Bundle Measures will assess lactate levels, obtaining blood cultures, administering broad spectrum antibiotics, fluid resuscitation, vasopressor administration, reassessment of volume status and tissue perfusion, and a repeat lactate measurement. The first three interventions in the process measure should occur within three hours of presentation of severe sepsis, while the remaining interventions are expected to occur within six hours of presentation of septic shock.

One may ask why CMS chose a bundle measurement. The bundle for sepsis is a structured way of improving patient care processes and outcomes by grouping together a small set of evidence-based interventions proven to improve patient outcomes. When performed collectively, the elements of a bundle have a greater impact on outcomes than each element performed separately. Bundling interventions increases the likelihood they will all be performed collectively and reliably. The power of a bundle comes from the body of science supporting it and the method of execution.

Elements of a bundle are not new. They are well established best practices that are often not performed uniformly, making treatment unreliable. By grouping a small number of these proven interventions (usually three to four) together in a bundle with clear parameters for implementation, the likelihood of them all being implemented appropriately increases significantly. Analysis of data from the Surviving Sepsis Campaign demonstrates that when all severe sepsis and septic shock bundle elements are performed consistently, outcomes are better than when even one bundle element is not performed correctly. A composite measure is way of reporting the results of a patient care bundle.

In order for hospitals to meet the requirements of the data collection for sepsis, they must document in the patient’s medical record all of the following:

For those patients with a diagnosis of SEVERE SEPSIS, hospitals must perform these items within three hours of presentation:

- Initial lactate level measurement
- Blood cultures (drawn prior to antibiotics)
- Administration of a broad spectrum or other antibiotic
- Repeat lactate level measurement only if initial lactate level is elevated within six hours

For patients with a diagnosis of SEPTIC SHOCK, hospitals must perform these items within three hours of presentation:

- Utilize fluid resuscitation with 30 ml/kg crystalloid fluids
- Utilize Vasopressors within six hours if hypotension persists after fluid administration
- If hypotension persists after fluid administration or initial lactate greater than or equal to 4 mmol/L, received within six hours of presentation of septic shock
• Repeat volume status and tissue perfusion assessment consisting of either
  ◦ A focused exam including: vital signs, and
  ◦ Cardiopulmonary exam, and
  ◦ Capillary refill evaluation, and
  ◦ Peripheral pulse evaluation, and
  ◦ Skin examination
  
  OR
  ◦ Any two of the following four:
    ◦ Central venous pressure measurement
    ◦ Central venous oxygen measurement
    ◦ Bedside cardiovascular ultrasound
    ◦ Passive leg raise or fluid challenge

Multiple studies have shown that, for patients with severe sepsis, standardized order sets, enhanced bedside monitoring, telemedicine, and comprehensive feedback modifies clinician behavior and is associated with decreased hospital mortality. The evidence will be seen directly related to decreases in organ failure and overall reductions in hospital mortality, length of stay, and costs of care.

The bottom line is that through surveillance of early effective treatment of severe sepsis or septic shock, hospitals will not only know where in the sequence of steps to treat severe sepsis and septic shock patients, but also begin to decrease mortality related to sepsis and the costs associated with inefficient care of severe sepsis and septic shock patients. With the implementation of this measure, CMS will be able to gauge if care of severe sepsis and septic shock patients is improving.

For more information, please contact Great Plains QIN/ South Dakota Foundation for Medical Care at 605.336.3505 or email me at stephan.schroeder@area-a.hcqs.org.
It’s been known for eons that in this northern clime, some people feel the winter blues set in when the nights become long, but it was a physician from the National Institutes of Health in the 1980s who first named that darkening of mood in winter as “seasonal affective disorder,” S-A-D, or SAD. Paradoxically, with the holiday season, mood can significantly sadden in 5 to 20 percent of us, depending somewhat on how northern your exposure may be.

Some people are just minimally affected, but those with a major depressive illness or manic-depressive condition, may be severely impaired by seasonal change. Certainly those who socialize poorly, move less, live in darker places, and hibernate indoors are at higher risk for winter blues.

The theory is that long nights alter melatonin and serotonin brain chemical levels, changing our biological clocks. Some experts think SAD is a reflection of thousands of generations when food was scarce in winter, making it necessary to turn down and do less. It’s not hard to believe that body juices and thus mood can be influenced by light. Think how poinsettia leaves turn red, or the Christmas cactus blossoms as our winter sets in.

Maybe it is not wrong to settle in on your favorite couch, in front of a warm fire, wrapped in a throw, engrossed in a good book, with a hot cup of your favorite winter beverage. Maybe even snatch a nap. Perhaps we should allow ourselves to take a little time to recharge before the excitement and high energy of spring and summer.

But we cannot forget how physical exercise every day keeps the doctor away. Winter without exertion means a spring-time of weakness and injury. We must keep fit even during the winter weather and even if that means exercise indoors.

I read one report that those living in Iceland do not struggle with SAD. It’s thought their lifestyle of rigorous outdoor winter physical activity, exposure to winter sun, and diet of vitamin D saturated fish is the tonic that prevents sadness.

For those who are possibly harmed by a bad mood brought on by the darker winter season, you might benefit from the Icelandic attitude of regular daily winter exercise, plenty of early morning light, outdoor sun when possible, and a diet that includes enough fish and/or vitamin D.

And maybe it’s OK to take some time this winter to cozy up and recharge a little too.
Legal Brief Highlight: Physician Employment Agreements

When negotiating an employment agreement, physicians should be mindful of the length of the term of employment, the method and means of termination, how compensation will be determined and paid, the avoidance of conflicts of interest, and the terms of any possible restrictive covenant.

It is recommend that physicians establish goals for the employment relationship before starting contract negotiations with the potential employer. As stated in the preface to the American Medical Association’s (AMA) Annotated Model Physician Employment Agreement, “[t]he time to think about your future and to do something about it is before the contract is signed, preferably before negotiations begin. Know what you want and why you want it; then ask for it.” The SDSMA Center for Physician Resources at www.sdsmoa.org and the AMA at www.ama-assn.org have several resources available to physicians that can help in establishing goals and reasonable expectations, and potentially avoiding pitfalls as well.

For more information, download the SDSMA legal brief Physician Employment Agreements at www.sdsmoa.org. Through the SDSMA Center for Physician Resources, the SDSMA has developed more than 40 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.

Source: SDSMA staff

For Your Benefit:

Fighting for You and Your Patients

The SDSMA serves as your vehicle for advocacy for your patients and the art and science of medicine through lobbying at the state and federal levels, grassroots activity and legal initiatives.

SDSMA PAC is your grassroots avenue that works to impact public policy decisions through bipartisan political participation. SDSMA PAC supports and elects pro-medicine candidates on the state level. SDSMA members and their spouses can join SDSMA PAC.

The SDSMA’s motto is “Values, Ethics, Advocacy.” We take our advocacy role to heart. With your help, SDSMA and SDSMA PAC have the opportunity to dramatically impact the political and legislative process to create meaningful changes in South Dakota’s current health care system:

- Improving health and access to care in rural areas;
- Increasing Medicaid reimbursement;
- Promoting Medicare physician payment reform and stopping reimbursement cuts;
- Working to improve clinical quality and patient safety;
- Partnering with state agencies to tackle regulatory, socioeconomic, public health and scientific policy issues;
- Advocating for public health immunizations;
- Promoting adequate funding for medical education;
- Stopping inappropriate expansion of non-physician scope of practice;
- Defending the patient-physician relationship; and
- Reforming medical liability.

If you would like to become involved in any of our advocacy programs, call 605.336.1965 or visit www.sdsmoa.org.

“For Your Benefit ” is the SDSMA’s monthly update on programs and services available to physicians through their affiliation with the SDSMA.
The South Dakota State Legislature began its 2016 session on Jan. 12 with Gov. Dennis Daugaard’s State of the State address in which he outlined his top priorities.

In his speech, Gov. Daugaard discussed Medicaid expansion, teacher salaries, and workforce development initiatives, among other topics. He weighed in on Medicaid expansion by asking the legislature to expand eligibility. Before us lies the opportunity to expand Medicaid without incurring additional costs to the state. The cost of expansion may be funded through additional dollars that will be received from the federal government as a result of the Centers for Medicare and Medicaid Services’ (CMS) proposed plans to enhance FMAP funding provided for American Indians. SDSMA strongly supports expansion of the eligibility for Medicaid in South Dakota to include uninsured individuals up to 138 percent federal poverty level and is asking the legislature for its support. Medicaid expansion will provide access to high quality health care services for an additional 50,000 South Dakotans, including 15,000 American Indians. Although he said he opposes the Affordable Care Act, Gov. Daugaard believes his proposed Medicaid expansion deal “makes sense for South Dakota.”

The governor’s proposal to expand Medicaid needs legislative authority in order to become law, and the governor suggested language be included in the proposed law to withdraw from expansion if the federal government changes its tune on IHS reimbursement, or if the federal government withdraws its funding. “We all owe it to the people of South Dakota to give this careful consideration this year,” he said. “I hope you’ll agree it just makes sense for our state.”

In addition to Medicaid expansion, the SDSMA’s 2016 Advocacy Agenda supports Medicaid health homes to coordinate care for individuals with chronic conditions, and opposes to further exemptions from certain childhood immunizations. Making sure patients have the opportunity to make well-informed decisions when it comes to a provider’s training, certification and field of expertise is also a priority for the SDSMA.

In addition, the SDSMA has long been an advocate for increased funding for medical education as the state’s need for physicians will only increase as our population ages. In 2014, the legislature approved Gov. Daugaard’s proposal to expand medical school slots by 44 students over the course of four years at the University of South Dakota Sanford School of Medicine. The SDSMA looks forward to continuing work with Gov. Daugaard and the legislature to address the state’s shortage of physicians to ensure access to high-quality care for South Dakota patients.

The SDSMA’s 2016 Advocacy Agenda is available at www.sdsm.org under the Advocacy tab.

Source: SDSMA staff

“The Issue Is” is the SDSMA’s monthly update on key policy issues of importance to physicians.

SDSMA President Completes Visits to Districts

SDSMA President Tim Ridgway, MD, has completed his travels to each of the 12 district medical societies, with the final meeting hosted by the Seventh District Medical Society Jan. 25 in Sioux Falls.

Dr. Ridgway and physicians attending the meetings discussed issues facing patients and physician practices, the challenges faced in health care in South Dakota and nationwide, and ways physicians can work together toward common goals. Members also discussed Gov. Dennis Daugaard’s fiscal year 2017 budget proposals and the SDSMA’s advocacy issues for the 2016 legislative session. Read more about the SDSMA’s 2016 Advocacy Agenda in this issue’s Member News feature, “The Issue Is.”

Source: SDSMA staff
“Apology in Medicine” Practice Support Presentation  
– 7 pm CT March 8

The SDSMA Center for Physician Resources brings you its Practice Support Series on Risk Mitigation at 7 p.m. CT Tuesday, March 8 with the presentation, “Apology and Communication in Medicine.” To register for this free webinar, find a link on the homepage calendar at www.sdsm.org. The remaining programs in this series include the following:

- 7 p.m. CT March 8 – Apology and Communication in Medicine
- 7 p.m. CT June 14 – Anatomy of a Medical Malpractice Lawsuit
- 7 p.m. CT Sept. 13 – Physician Resiliency: Healing the Healer

This series will also provide key advice on the litigation process and how to get through a malpractice claim both personally and financially.

Source: SDSMA staff

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Read InSession for Legislative News

The SDSMA’s weekly email InSession keeps you informed about the SDSMA’s legislative activities and key health-related bills and action alerts.

InSession is emailed to all members once a week during the legislative session, providing a timely look at the actions of the legislature. Issues are also posted online at www.sdsm.org.

Source: SDSMA staff

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Photo courtesy of Sioux Falls Convention & Visitors Bureau

February 2016 93
CME Events

February 2016

February 3
Internal Medicine Grand Rounds – New Insights and Intervention Thresholds in the Diagnosis and Treatment of Osteoporosis
AMA PRA Category 1 Credit(s)” available
Register online:
usdssom.learningexpressce.com

February 3
Surgery Grand Rounds – Surgical Management of Renal Cell Carcinoma
AMA PRA Category 1 Credit(s)” available
Register online:
usdssom.learningexpressce.com

February 4
Pediatric Grand Rounds – Sexually Transmitted Diseases in the Pediatric Patient
AMA PRA Category 1 Credit(s)” available
Register online:
usdssom.learningexpressce.com

February 10
Internal Medicine Grand Rounds – Transition to Adult Care for Youth and Young Adults with Disabilities and/or Chronic Health Conditions
AMA PRA Category 1 Credit(s)” available
Register online:
usdssom.learningexpressce.com

February 17
Internal Medicine Grand Rounds – Frailty
AMA PRA Category 1 Credit(s)” available
Register online:
usdssom.learningexpressce.com

February 17
Surgery Grand Rounds – Sleep Deprivation and Fatigue Management
AMA PRA Category 1 Credit(s)” available
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February 17
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February 18
Pediatric Grand Rounds
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February 24
Internal Medicine Grand Rounds
AMA PRA Category 1 Credit(s)” available
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February 25
Pediatric Grand Rounds
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Register online:
usdssom.learningexpressce.com

DO YOU HAVE A CME EVENT COMING UP? WOULD YOU LIKE TO HAVE IT LISTED HERE?

Contact: Elizabeth Reiss,
South Dakota Medicine,
2600 W. 49th Street, Suite 200,
Sioux Falls, SD 57105
Phone: 605.336.1965
Fax: 605.274.3274
Email: ereiss@sdsma.org

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For additional information please email Ann Ryken at aryken@yanktonmedicalclinic.com.

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