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Protecting Your Online Information

We frequently receive questions from clients about how to best protect their identity online. Prior data breaches have taught us some important lessons about what to do if we know, or if we fear, our personal information has been compromised. Here are a few tips to consider:

1. **CHANGE YOUR PASSWORDS** to all online accounts if your assessment of impact indicates vulnerability. Make sure the new passwords are substantially different than those used previously.

2. **USE UNIQUE PASSWORDS** for each account or site. Reusing passwords makes all accounts that use that same password vulnerable, even if they were not directly compromised.

3. **KEEP PASSWORDS SIMPLE, LONG AND MEMORABLE** are new recommendations from the NIST (National Institute of Standards and Technology). Think entire phrases; longer = stronger.
   
   Examples of long passwords using phrases:
   
   ilovetogofishingin55723! OR Thekidspurednailpolishon50%ofthecouch

4. **UTILIZE MULTI-FACTOR AUTHENTICATION** (‘MFA’) or Two-Factor Authentication (‘2FA’) whenever possible. MFA combines two or more independent credentials: what the user knows (password) and what the user has (security token/text message/app approval/fingerprint). If one factor is compromised or broken, the attacker still has at least one more barrier to breach before successfully breaking into the target.

5. **USE A PASSWORD MANAGER** (e.g., LastPass, 1Password, KeePass) to maintain multiple account passwords, but make sure to keep that account extremely safe; use a strong unique password, secure it with MFA, and backup the data.

6. **USE A TYPE OF LOGON AUDITING** offered by many services. This allows you to see recent security events and login location history. Keep an eye on this for suspicious activity.

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I recently spoke to one of my good friends. We met in 1972 as first year medical students in Vermillion. We became good friends and in 1974 we both transferred to Tufts University Medical School in Boston. When we arrived in Boston, two things became obvious:

- We both felt fortunate to be attending medical school in Boston.
- We realized the value of the two-year basic science education in Vermillion.

The metaphor “on the shoulders of giants” has been traced to Bernard of Chartres. It describes a dwarf standing on a giant’s shoulders “discovering truth by building on previous discoveries.” Sir Isaac Newton has been given credit for a more modern interpretation: “If I have seen further, it is by standing on the shoulders of giants.” For all of us who have the privilege to practice medicine, we can all think of our own personal “giants” in our past who have helped us see further.

One of my favorite courses in Vermillion was the Pathology course that dominated the second year of basic science. The Pathology course was taught by the pathologists (“giants”) from the Laboratory of Clinical Medicine (LCM) in Sioux Falls. LCM was the pathology group associated with Sioux Valley hospital (now Sanford). Drs. Karl Wegner, John Barlow and Richard Jaqua were our instructors for the course. All three of these giants trained in pathology at the MGH (Massachusetts General Hospital) with Dr. Benjamin Castlemen. Dr. Jaqua also did additional training at the NIH and Memorial Sloan Kettering Hospital before joining LCM. Of the three pathologists, Dr. Jaqua was our most frequent speaker for the Pathology Course.

Drs. Wegner and Jaqua are both deceased. I truly regret that I never thought to thank them for our Pathology experience in Vermillion. I did see Dr. Barlow when I visited Rapid City on the District tour this year. It was great to see him and I did get a chance to thank him for his teaching efforts.

This is my last editorial contribution as SDSMA President. It has been an honor and privilege to serve as President of our Medical Association. I would agree with past Presidents that the highlight of the Presidential year is the statewide district visits. It was great to see many old friends and to meet new physicians on the statewide visits.

I also wish to express my gratitude and thanks to the physicians who have been involved in the Medical Association. Thank you to all of the physicians who are serving the Medical Association in the new Policy Council, multiple task forces, working committees, the SDMSA PAC and Foundation.

Thank you to the members of the Executive Board for their advice and leadership this past year: Ben Aaker, Chris Dietrich, Kara Dahl, Lucio Margallo, Mark Harlow, Mary Carpenter, Robert Marciano, Rob Allison, Robert Summerer, and Tom Hermann. Our organization is blessed to have such a leadership group.

A special thank you to our wonderful SDSMA staff (Barb, Mark, Terry, Elizabeth and Laura) for everything they do. I have a new appreciation for their expertise and dedication. I also want to thank our lobbyist Dean Krogman for his work with the Legislature in Pierre.

A special thank you to the past Presidents and Executive Board members for their support and counsel. Congratulations to Dr. Chris Dietrich from Rapid City as he begins his Presidential term this coming June. The Medical Association will be in good hands.

I would like to invite everyone to attend our next annual SDSMA meeting. The 2018 SDSMA Annual Leadership conference will be held June 1, 2018 at the Hilton Garden Inn in Sioux Falls. Scheduled events include:

- AMA Update
- Sanford School of Medicine Update
- Membership Open Forum
- Panel Discussion on Opioids
- SDSMA PAC Lunch
- Policy Council Meeting
- Membership Mixer
- Awards Banquet and Scholarship Recognition

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The Liaison Committee on Medical Education (LCME) completed its accreditation review of the USD Sanford School of Medicine and determined that the school met the guidelines to be fully accredited. The next review will occur in eight years, the maximal term that a school can receive. The school was found to be in compliance with all twelve over-arching accreditation standards. There were many areas of excellence that were highlighted by the site visitors including the responsiveness of administration to student concerns, the dedicated and engaged faculty and institutional partners, and the high quality facilities. In addition, the site visit team noted that the school had “a well-designed, innovative, self-directed, and integrated educational program that is well-matched with the school’s mission, institutional partners and state needs.”

As we reflect on the accreditation process, three themes emerge. First, a medical education program is highly complex and dependent upon many integrated efforts. The student experience from admission to graduation requires sophisticated programs for academic and career advising, careful attention to student wellbeing, and assistance with management of debt. The curricular underpinnings must be based on clear objectives with appropriate assessment and quality feedback. The school needs to assure medical students become self-directed life-long learners during medical school. Scholarship must include bench and clinical/translational research opportunities for students, so that scientific inquiry is always a part of their practice. The relationship of a medical school to its clinical partners and community members is critical. Nowhere is this truer than here in South Dakota! Our community-based medical school is dependent on partners throughout the state to deliver high-quality educational experiences to our students. Faculty need support and opportunities for development in order to provide their services. Physical facilities and technical resources require sufficient financial infrastructure to keep the school running. All of these efforts need to work together successfully, and all were reviewed by the accreditation site visit team.

Second, we note the importance of our many dedicated faculty. Their work is deeply appreciated. More than 1500 physicians across the state dedicate time and effort to medical education. Basic science faculty, course and clerkship directors, department chairs and clinical academic faculty devote their skills to student education. One of the hallmarks of this school is the one-on-one teaching by faculty. Our students value this and so do we.

Third, as many of you have noted, the caliber of our students is remarkable! Their commitment to excellence was evident in their participation in the accreditation process. They created and administered a massive survey that provided the school with balanced feedback on the school’s programs and services. Their professionalism was evident as they met with the site visitors.

As another school year draws to a close we have much for which to be thankful. We are deeply grateful to all who were involved in this highly successful review!

About the Authors:
Janet Lindemann, MD, MBA, Dean of medical student education University of South Dakota Sanford School of Medicine
Mary Nettleman, MD, MS, MACP, Dean, USD Sanford School of Medicine
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Aneurysm of the Splenomesenteric Portal Venous Confluence: A Case Report

By Sarah Ashmore, BS, MSIV; and Kelly Stacy, MD, FACP

Abstract

A 62-year-old Caucasian woman was found to have an aneurysm of the splenomesenteric portal venous confluence via computed tomography (CT) scan after presenting with left upper abdominal tenderness. Venous aneurysms typically occur in the popliteal, jugular, and saphenous veins, but visceral venous aneurysms are rare. These aneurysms most commonly arise from the main portal vein and the confluence of the splenic and superior mesenteric veins. There have been fewer than 50 reported cases of portal venous aneurysm. Evaluation involves imaging modalities such as ultrasound, CT, magnetic resonance imaging (MRI), and angiography. There is currently no clear guideline for management, but options include observation, resection, thrombectomy, or portal venous decompression.

Introduction

Venous aneurysms typically occur in the popliteal, jugular, and saphenous veins, but visceral venous aneurysms are rare. These aneurysms most commonly arise from the main portal vein and the confluence of the splenic and superior mesenteric veins. Barzill and Klecker described the first portal vein aneurysm in 1956. Since these discoveries, there have been fewer than 50 cases of portal system aneurysms. The number of incidental findings of visceral venous aneurysms is growing due to increased availability of advanced radiologic imaging. The purpose of this manuscript is to discuss a rare case of an aneurysm of the splenomesenteric portal venous confluence and review the literature on visceral venous aneurysms.

Case

A 62-year-old Caucasian woman presented with abdominal tenderness located in the left upper abdomen two months previously. The tenderness varied in quality with alternating symptoms of bloating, aching, dull, sharp, and tender pain. The tenderness was moderate with a severity of 4 out of 10 and constant without radiation. There were no ameliorating symptoms, while aggravating symptoms included bending over, standing up, and twisting/turning.

The patient also experienced fever, chills, and nausea. She denied hematuria, heartburn, or shortness of breath. Physical examination revealed stable vital signs, body mass index (BMI) of 28.2, cardiac examination revealed regular rate and rhythm with normal heart sounds, and lungs were clear to auscultation bilaterally. Abdominal exam displayed hyperactive bowel sounds, no masses, hepatosplenomegaly, rebound tenderness, costovertebral tenderness, or abdominal bruit. The abdomen was distended with left upper quadrant guarding and tenderness. Previous colonoscopy a month earlier revealed evidence of diverticulosis. The patient’s medical history included hypothyroidism, hypercholesterolemia, migraines, and malignant melanoma status post surgical resection. Surgical history included two caesarean sections, tubal ligation, cholecystectomy, and appendectomy. The patient had no personal or family history of aneurysms.

Outpatient workup included computed tomography (CT) of the abdomen that revealed a dilatation involving the splenomesenteric portal venous confluence. The dilatation was consistent with a venous aneurysm and measured 3.2 cm in diameter (Figures 1-2). Sigmoid diverticulosis was also seen with no acute diverticulitis. Repeat imaging was performed eight months later to assess the stability of the
aneurysm. A focal dilatation was visualized once more with the greatest A-P diameter unchanged, but the greatest transverse diameter appeared to increase. The patient's imaging was sent to the chair of the Division of Vascular and Endovascular Surgery at the Mayo Clinic for further input on management options.

The chair reviewed the CT scans of the patient's portal mesenteric venous system and aneurysm. He felt there were minimal changes in diameter of the aneurysm and no evidence of thrombus or portal hypertension. Since the patient symptoms were stable and the aneurysm was recently discovered, he recommended conservative management with repeat CT or ultrasound scans within the following year or sooner if symptoms warrant it. Repair was recommended if the patient develops further abdominal or epigastric pain with no other cause, if the aneurysm grows, or if thrombus develops. The etiology of the aneurysm is currently unknown.

Discussion

Visceral venous aneurysms are asymptomatic or can present with upper abdominal pain or jaundice. Etiology is either congenital or acquired. Congenital causes include abnormality of the internal wall of the vessel, incomplete regression of the distal right primitive vitelline vein, or a variant branching pattern of the portal vein. Chronic liver disease, portal hypertension, pancreatitis, trauma, and sequel after surgery are some of the acquired causes. Different imaging modalities can be used for diagnosis including the following: ultrasound, color Doppler ultrasound, CT, magnetic resonance imaging (MRI), and angiography. The natural course of visceral venous aneurysms is unknown, which makes management decisions controversial. These aneurysms are at risk for thrombosis, portal hypertension, compression of adjacent structures, and rupture. Currently, there is no guideline for management of portal system aneurysms. Authors appear to agree that asymptomatic patients without evidence of portal hypertension or cirrhosis can be managed with conservative treatment including routine follow up imaging. Patients who are symptomatic or demonstrate expansion of the aneurysm should be surgically managed due to the increased risk for thrombosis and rupture. Surgical options include aneurysmorrhaphy, portacaval shunt, and mesocaval shunt. Those with portal hypertension should explore porto-systemic shunt operations. Since there are such few cases of portal system aneurysms, management decisions are decided on a case-by-case basis until there is consensus about treatment options.

Conclusion

Portal system aneurysms are rare. There is no clear guideline of their management; therefore decisions should be made on a case-by-case basis. This patient presented with stable left upper quadrant abdominal tenderness. The diameter of the aneurysm changed minimally between the
first and second CT scans. Since the patient symptoms are not increasing in severity and the aneurysm has stabilized, the patient will be managed conservatively with follow up imaging within the following year.

Acknowledgements: The author would like to thank her mentor, Dr. Kelly Stacy, for her support and contribution, and would like to extend appreciation to Dr. Thomas Bower, chair of the Division of Vascular and Endovascular Surgery at the Mayo Clinic, for his contribution of expertise to this case report.

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About the Authors:
Sarah Ashmore, MSIV, University of South Dakota Sanford School of Medicine, Rapid City, South Dakota.
Kelly Stacy, MD, FACP, Regional Medical Clinic, Rapid City, South Dakota; Clinical Faculty, University of South Dakota Sanford School of Medicine, Rapid City, South Dakota.

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Validating a Survey for Addiction Wellness: The Recovery Capital Index

By David Whitesock, JD/MA; Jing Zhao, PhD; Kristen Goettsch, MA; and Jessica Hanson, PhD

Abstract

Background: Evaluating addiction wellness encompasses more than sobriety. The Recovery Capital Index (RCI), developed by Face It TOGETHER (FIT), measures addiction wellness using three domains and 22 components providing a comprehensive baseline and assessment of intervention effectiveness to allow for the tracking of client progress and to tailor support. The RCI is a holistic, person-centered metric irrespective of a person’s treatment modality, recovery, or wellness pathway.

Methods: FIT and Sanford Research set a goal to validate the RCI’s effectiveness to measure the factors associated with addiction wellness through a retrospective cohort study of FIT clients with the disease of addiction to alcohol and/or other drugs. Study cohort included 154 client intake records with corresponding RCI scores. The RCI was subjected to descriptive analyses using stacked barplots and side-by-side boxplots. The Cronbach and correlation coefficients were used to check the reliability and validity of the components within each domain. Differences of RCI against clients’ characteristics were examined using Tukey’s test of multiple comparisons of means.

Results: The validation process verified the design of the RCI domains – personal, social, and cultural capital. Variables significantly related to addiction wellness, based on the RCI, are: primary addiction, addiction identification, employment, and income. The RCI accurately described the individual’s current state of recovery.

Conclusions: This project validated the RCI as a tool to measure addiction wellness. The RCI measures what it is intended to measure. The results allow FIT and Sanford Research to next validate the RCI instrument’s predictive nature for measuring behavior change.

Background

For as long as individuals have been surviving alcohol and other drug addiction (also understood as substance use disorder) – entering and maintaining “recovery” – there has lacked a method or instrument for measuring the broad and ambiguous concept of recovery. Generally, the use or non-use of a substance has been a leading or primary indicator of treatment and/or recovery success. With other indicators, such as employment, housing, and criminal justice involvement, the scope of measurement has been limited to a specific demographic – an underserved and less economically positioned population. Despite treatment providers, criminal justice, and other agencies’ continued reliance on abstinence as a measure of success (e.g., program completion, recovery, etc.), a mainstream acceptance of a more holistic measurement is prevailing, albeit, against competing definitions of recovery.

Two of the most respected organizations in the addiction field – Substance Abuse and Mental Health Services Administration (SAMHSA) and Betty Ford Institute (now Hazelden Betty Ford Foundation) – have illustrated the lack of consensus around the notion of recovery. SAMHSA defines recovery as a “process of change through which individuals improve their health and wellness, live a self-directed life, and strive to reach their full potential.” The Betty Ford Institute Consensus Panel
defined recovery as “a voluntarily maintained lifestyle characterized by sobriety, personal health, and citizenship.” With the merger of Betty Ford and Hazelden in 2014, Hazelden Betty Ford has taken on a recovery definition less tethered to sobriety; however, as a 12-step based treatment provider, sobriety is still a key indicator of success and wellness. SAMHSA, on the other hand, recognizes that, like many chronic illnesses involving internal and external factors, addiction recovery is not a zero-sum circumstance. SAMHSA supplemented its recovery definition and established four holistic dimensions that support a life in recovery:

1. Health: a process for overcoming or managing one’s disease(s), symptoms, or recovery as the individual makes informed, healthy choices that support physical and emotional wellbeing;
2. Home: having a stable and safe place to live;
3. Purpose: meaningful daily activities and the independence, income, and resources to participate in society; and
4. Community: relationships and social networks that provide support, friendship, love, and hope to the individual in recovery.

While both SAMHSA and Hazelden Betty Ford have expanded their definition of recovery, it can be enhanced through the concept of recovery capital. Recovery capital attempts to establish a more interoperable definition to this notion of recovery. White and Cloud (2008) define recovery capital as “the breadth and depth of internal and external resources that can be drawn upon to initiate and sustain recovery from severe [alcohol and other drug] problems.” Connecting this with SAMHSA’s definition of recovery, the recovery process requires the individual to use internal and external factors to advance their overall wellbeing. Best and Laudet (2010) define the individual’s recovery core as “lived experience of improved life quality and a sense of empowerment,” implying that there is no single end goal. As with other chronic illnesses or health in general, addiction recovery is not a destination but an ongoing quest for a better life.

With a vested interest in understanding holistic addiction recovery, Face It TOGETHER (FIT) is a social entrepreneurial non-profit, based in Sioux Falls, South Dakota, working to solve the disease of addiction. FIT is using the above-mentioned concepts and definitions to explore recovery capital in terms of a change process. The focus is on determining if asset predictors can be identified for intervention success or quality of life improvement. More critically, FIT is interested in understanding that if the asset predictors were known, could more relevant interventions be applied to maximize the growth of recovery capital, creating a compounding effect on overall quality of life. FIT provides peer-based recovery coaching to those struggling with addiction, in recovery, or the loved one of someone with the disease. The peer recovery coach, either a person with the disease or a loved one, is trained to use coaching techniques and their lived experience to guide others through the addiction wellness process. FIT peer recovery coaches, neither clinically trained nor 12-step sponsors, often supplement clinical treatment and assist clients with goal setting and navigation of systems and services.

**Recovery Capital Frameworks.** Recovery capital has its roots in the notion of social capital. Social capital has been defined as “the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition.” Generally, social capital has been a sociological concept attempting to give meaning to non-economic relationships across human interaction. Granfield and Cloud applied this concept of social capital to addiction recovery in 2001. The nearly 40 years’ worth of research on social capital has established a solid foundation upon which to build the notion of recovery capital.3,6,7

Conceptually, recovery capital is a logical model for defining a complex notion of wellness or the sum of resources necessary to initiate and sustain recovery from alcohol and other drug addiction. White and Cloud (2008) developed an early methodology for integrating recovery capital and problem severity assessments to determine appropriate levels of clinical care. The Recovery Capital/Problem Severity Matrix provides a framework for determining level of care placement depending on the significance of the problem and the person’s corresponding recovery capital. While this is a laudable first step, measuring a person’s progress through wellness must go beyond care placement or even relapse risk, and focus on measuring all stages of the recovery process.

To do this, Cloud and Granfield chartered, and expanded upon, a framework building on the social capital construct, which currently includes four components of recovery capital:

1. Social capital is defined as the totality of individual’s
relationship assets, including support and obligations to individuals and groups;

2. Physical capital is defined as the collection of tangible assets including finances, housing, food, or more aptly stated, basic human needs;

3. Human capital is defined as the less tangible of individual’s assets such as problem solving skills, education, good health, and a general sense of hope; and

4. Cultural capital is defined as external aspects encompassing the individual’s values, beliefs, and connection to other social or community specific norms.6–8

White and Cloud (2008) considered a more traditional and recovery oriented approach. Within their construct, building upon recovery capital as defined by Cloud and Granfield, the four components (Personal Recovery Capital, Family/Social Recovery Capital, Community Recovery Capital, Cultural Recovery Capital) are addiction-centered aspects specific to individuals with alcohol and other drug problems. White and Cloud assert that recovery capital is “linked to natural recovery, solution-focused therapy, strengths-based case management, recovery management, resilience and protective factors, and ideas of hardiness, wellness, and global health.”9

Recovery Capital Index. These constructs of recovery and recovery capital provide a solid definition of the essence of addiction wellness: a lived experience of improved life quality and a sense of empowerment and purpose. Unfortunately, there are few effective and comprehensive measures for recovery from alcohol and other drug addiction. Moreover, most client outcomes are measured simplistically by the use or non-use of a substance and/or the completion of a time-limited clinical treatment program. FIT recognizes that addiction wellness encompasses much more than sobriety, so the organization took these constructs of recovery capital one step further to develop and validate an instrument that would provide insight into the individual’s asset predictors for quality of life improvement.

The Recovery Capital Index (RCI) is a holistic, person-centered metric, irrespective of a person’s treatment modality or recovery or wellness pathway, and can be used at all stages of the wellness process. Using a multidimensional score from 1 to 100 to measure an individual’s addiction wellness, the RCI provides a comprehensive baseline and tracks intervention effectiveness, allowing clinicians, peer coaches, and other care team members to follow individual progress to tailor intervention and support at any point in the continuum of care.

To construct the RCI, FIT built on the recovery capital foundational work of the field. The number of domains was reduced to three to better align physical and human capital and to ensure relevancy for its use with addiction sufferers and non-sufferers alike. The principles of Cognitive Behavioral Therapy and Motivational Interviewing are at the heart of the RCI’s design.9 The instrument incorporates previously validated metrics from other well-known resources, such as the Behavioral Risk Factor Surveillance System Questionnaire (BRFSS), General Well-Being Schedule,11 World Health Organization Quality of Life Spirituality, Religiousness, and Personal Beliefs Questionnaire (WHOQOL-SRPB),12 and the PTSD Check List - Civilian Version (PLC-C).13

The RCI is structured across three domains and 22 components, through 68 metrics (Figure 1). The instrument is implemented at intake and every 90 days following. The instrument is not weighted and presents each respondent with an individual raw score on a scale of 0 to 100. The RCI establishes a recovery capital baseline.

![Figure 1. RCI construct](image-url)
that can be used to inform a peer recovery coach (or other care provider) and a person impacted by the disease of addiction about areas of concern or success that strategies and/or interventions can be built around. Further, the RCI measures individual progress over time, identifying and measuring the increase or decrease of recovery capital – internal and external resources or assets – in the person’s life. Over time, the RCI is intended to measure the effective change against various interventions or modalities of care as provided by FIT (or other care providers using the instrument).

The initial RCI instrument was developed by an external research and evaluation scientist using an expansive literature review, including identifying validated questionnaires in the public domain and possible constructs or models for framing the question set. The RCI framework was based on the Social Progress Index (SPI), a measurement for global social change. The original RCI included more than 120 metrics, and was pilot tested with FIT peer recovery coaching clients in Sioux Falls, South Dakota. Based on those results, numerous questions were modified or eliminated. An additional validation review was conducted by an expert in psychology to establish the face content validation of the instrument. This review determined that the instrument was clearly organized and identified some content changes to ensure that the metrics were appropriately matched with what it was intending to assess, recovery capital.

The RCI is administered to all FIT clients at intake and every 90 days following. The most critical evaluation period is during the first three months. This time period usually involves the highest engagement and intensity for treatment and recovery. The recommended administration intervals are built into FIT’s proprietary digital health platform, AXIS; however, clinicians and care providers may administer or the client may request to complete the RCI at a greater frequency. The RCI is completed by the client on paper and the results are entered by FIT team members into AXIS with a protocol to ensure accuracy by double checking each response entered. Reports and dashboards on the RCI, through AXIS, provide real-time, trending, and longitudinal analysis of the data. All data is collected, stored, and analyzed by FIT in compliance with HIPAA and other privacy and security regulations.

In 2017, FIT began a collaboration with researchers at Sanford Research in Sioux Falls, South Dakota, to conduct further validation of the criterion of the instrument to ensure that it is measuring what is supposed to be measuring. The purpose of this article is to describe this validation study.

Methods

Study Design and Measures. Since this study was a retrospective cohort study of FIT clients with the disease of addiction to alcohol and/or other drugs, all of the available clients in AXIS, FIT’s proprietary database, were included. RCI score, along with the client demographic and addiction-specific information, were collected and combined to provide validation materials of the RCI.

Client characteristics were collected through FIT’s demographic and intake survey instrument, which included an option to clients to decline answering any of the questions. Employment status was a current representation of the client’s state of employment (e.g., full-time, unemployed, etc.) and annual income level following the categories used by the U.S. Census (e.g., no income to over $150,000). Education level followed the categories used by the U.S. Census measuring from no schooling to advanced degrees. Legal status described the client’s involvement with the criminal justice and judicial systems (e.g., no legal issues, current or past incarceration, etc.). The addiction-specific items included: treatment-counseling status (i.e., in treatment – out-patient, in treatment – residential or in-patient, not in treatment or counseling) and the client’s self-identified primary and secondary addiction (e.g., alcohol, cocaine, heroin, marijuana, prescription drugs, methamphetamine, etc.).

The RCI was based on three primary domains shown to play an integral role in an individual’s ability to get well from addiction: personal, social, and cultural capitals. Within these three domains there were 22 separate components (Figure 2). The component framework was modeled on the Social Progress Imperative’s SPI, developed to holistically measure social and environmental factors – not economic factors – that contribute to the social progress of a country. Countries were made up of individual lives that have “basic human needs”, require “foundations of wellness”, and seek “opportunity” for growth. FIT studied the various components of the SPI – nutrition, basic medical care, shelter, access to basic knowledge, health and wellness, personal rights, and access to advanced education – and the data or surveys that populated the various components. The SPI was a validating framework at a much larger scale of the concepts behind recovery capital and the components of
assets key to an individual’s positive addiction wellness. Like the SPI, the RCI was designed to measure outcomes not identify inputs. While there remains a need to advance the evidence behind various modalities of addiction treatment and peer recovery coaching, little evidence exists on the actual outcome or outcomes of a person’s life impacted by addiction. The RCI was designed to establish a comprehensive picture of a complex web of outcomes relating to a person’s wellness that is achieved over time.

Data Analyses for Index Validity and Reliability. The quality of data sets for RCI score and intake information was examined using descriptive statistics such that missing values were detected and removed. Data imputation was not performed due to a lack of prior information regarding the associations between RCI and clients’ characteristics that is required to construct the imputation algorithm.

As a first step to determine the validity of the RCI, we ensured that all items met basic criteria for sufficient variability, such that they could discriminate sensitively between individuals on the underlying construct. The 68 initial items were subjected to descriptive analyses using stacked barplots. The distributions of components within each capital were illustrated using boxplots.

Secondly, the Cronbach was used to check the reliability of the subscales within each capital. Spearman correlation matrix of the subscales within each capital was performed to examine the content validity. Furthermore, inter-capital correlations were conducted to test the construct validity whether a unique index could be representative of multiple domains.

Finally, differences of RCI against various client characteristics were examined using Tukey’s test of multiple comparisons of means. This analysis was used to understand the sensitivity of the RCI on key risk and demographic factors. A p value of less than 0.05 was considered significant in the aforementioned tests.

Protections. This instrument validation study was reviewed by the Sanford Health Institutional Review Board on Oct. 4, 2017, identified as not human research, and exempt from a full review. Assessments used in this retrospective review were non-identifiable and collected through FIT clients as part of the coaching program that they consented to participation in. The FIT informed consent is for participation in services and ongoing assessment and to inform and identify processes for data collection, secure storage, and release of information.
following additional consent. Clients also consent to periodic assessment or evaluation of their recovery or wellness progress through questionnaires. Clients are informed that they participation is “optional” and that any information collected and stored will be held confidential, securely stored, and may be used to assist FIT in evaluating our services.

Results

Study Cohort. A total of 303 clients’ retrospective, since 2016, intake data were retrieved from the database. Of those, 154 had corresponding RCI scores. Cohort was selected from all clients of FIT’s addiction management center who had participated in coaching (in person or phone) and completed at least one RCI. Clients represented in the study cohort typically had some college education; were employed full time and made less than $75,000 annually; and were either free from or currently working through legal issues. These clients typically identified as being in recovery; had either completed none or were currently working through out-patient or individual counseling; and reported alcohol as their primary addiction (Table 1).

Descriptive Analyses of RCI. The variability of clients’ responses to each item in the RCI was visualized using stacked barplots (Figure 3). The total width of any bar was equal to the total number of each item responses. Most of the items had responses covering all five categories and had very small proportion of “Neutral” answers. It is also worth noting that some of the item responses were dominated by “agree” or “strongly

<table>
<thead>
<tr>
<th>Table 1. Study cohort demographics and intake variables</th>
<th>% of cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Addiction</strong></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>62.9</td>
</tr>
<tr>
<td>Cocaine</td>
<td>0.5</td>
</tr>
<tr>
<td>Other</td>
<td>2.2</td>
</tr>
<tr>
<td>Heroin</td>
<td>2.2</td>
</tr>
<tr>
<td>Marijuana</td>
<td>6.5</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>20.4</td>
</tr>
<tr>
<td>Prescription</td>
<td>5.4</td>
</tr>
<tr>
<td><strong>Addiction Identification</strong></td>
<td></td>
</tr>
<tr>
<td>Struggling</td>
<td>29.8</td>
</tr>
<tr>
<td>In Recovery</td>
<td>68.0</td>
</tr>
<tr>
<td>NA</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Treatment Counseling Status</strong></td>
<td></td>
</tr>
<tr>
<td>In treatment, out-patient or individual counseling</td>
<td>43.4</td>
</tr>
<tr>
<td>In treatment, residential or in-patient</td>
<td>9.2</td>
</tr>
<tr>
<td>Not in treatment or counseling</td>
<td>43.9</td>
</tr>
<tr>
<td>NA</td>
<td>3.5</td>
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<tr>
<td><strong>Legal Status</strong></td>
<td></td>
</tr>
<tr>
<td>Current legal issues</td>
<td>42.5</td>
</tr>
<tr>
<td>Previous legal issues</td>
<td>4.4</td>
</tr>
<tr>
<td>No legal issues</td>
<td>50.5</td>
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<tr>
<td>NA</td>
<td>2.6</td>
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<tr>
<td><strong>Employment</strong></td>
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</tr>
<tr>
<td>Unemployed</td>
<td>24.5</td>
</tr>
<tr>
<td>Other</td>
<td>4.4</td>
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<tr>
<td>Full-time</td>
<td>52.2</td>
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<tr>
<td>Part-time</td>
<td>12.5</td>
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<tr>
<td>Unknown</td>
<td>6.5</td>
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<tr>
<td><strong>Income Level</strong></td>
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</tr>
<tr>
<td>Less than $25,000</td>
<td>43.4</td>
</tr>
<tr>
<td>$25,000 - $75,000</td>
<td>25.4</td>
</tr>
<tr>
<td>More than $75,000</td>
<td>7.5</td>
</tr>
<tr>
<td>Unknown</td>
<td>16.2</td>
</tr>
<tr>
<td>Decline</td>
<td>7.5</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>No diploma</td>
<td>5.7</td>
</tr>
<tr>
<td>High school diploma or equivalent</td>
<td>18.4</td>
</tr>
<tr>
<td>Some college, no degree</td>
<td>25.5</td>
</tr>
<tr>
<td>Post-secondary degree</td>
<td>30.7</td>
</tr>
<tr>
<td>Advanced degree</td>
<td>6.1</td>
</tr>
<tr>
<td>Unknown</td>
<td>10.1</td>
</tr>
<tr>
<td>Decline</td>
<td>3.5</td>
</tr>
</tbody>
</table>
Table 2. Spearman correlation matrix of 9 subscales

<table>
<thead>
<tr>
<th></th>
<th>Health and Wellness</th>
<th>Knowledge and Skills</th>
<th>Basic Human Needs</th>
<th>Family and Home</th>
<th>Social Network</th>
<th>Health Activities and Environment</th>
<th>Social Values</th>
<th>Spirituality and Purpose</th>
<th>Community Connectedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and Wellness</td>
<td>1.00</td>
<td>0.48</td>
<td>0.47</td>
<td>0.29</td>
<td>0.31</td>
<td>0.44</td>
<td>0.30</td>
<td>0.50</td>
<td>0.42</td>
</tr>
<tr>
<td>Knowledge and Skills</td>
<td>0.48</td>
<td>1.00</td>
<td>0.55</td>
<td>0.28</td>
<td>0.16</td>
<td>0.47</td>
<td>0.18</td>
<td>0.30</td>
<td>0.37</td>
</tr>
<tr>
<td>Basic Human Needs</td>
<td>0.47</td>
<td>0.55</td>
<td>1.00</td>
<td>0.42</td>
<td>0.22</td>
<td>0.59</td>
<td>0.25</td>
<td>0.34</td>
<td>0.41</td>
</tr>
<tr>
<td>Family and Home</td>
<td>0.29</td>
<td>0.28</td>
<td>0.42</td>
<td>1.00</td>
<td>0.37</td>
<td>0.47</td>
<td>0.20</td>
<td>0.25</td>
<td>0.36</td>
</tr>
<tr>
<td>Social Network</td>
<td>0.31</td>
<td>0.16</td>
<td>0.22</td>
<td>0.37</td>
<td>1.00</td>
<td>0.32</td>
<td>0.32</td>
<td>0.34</td>
<td>0.49</td>
</tr>
<tr>
<td>Health Activities and Environment</td>
<td>0.44</td>
<td>0.47</td>
<td>0.59</td>
<td>0.47</td>
<td>0.32</td>
<td>1.00</td>
<td>0.51</td>
<td>0.46</td>
<td>0.57</td>
</tr>
<tr>
<td>Social Values</td>
<td>0.30</td>
<td>0.18</td>
<td>0.25</td>
<td>0.20</td>
<td>0.32</td>
<td>0.51</td>
<td>1.00</td>
<td>0.58</td>
<td>0.54</td>
</tr>
<tr>
<td>Spirituality and Purpose</td>
<td>0.50</td>
<td>0.30</td>
<td>0.34</td>
<td>0.25</td>
<td>0.34</td>
<td>0.46</td>
<td>0.58</td>
<td>1.00</td>
<td>0.52</td>
</tr>
<tr>
<td>Community Connectedness</td>
<td>0.42</td>
<td>0.37</td>
<td>0.41</td>
<td>0.36</td>
<td>0.49</td>
<td>0.57</td>
<td>0.54</td>
<td>0.52</td>
<td>1.00</td>
</tr>
</tbody>
</table>
agree”, such as items 1 and 7, while others were overshadowed by “disagree” or “strongly disagree” answers, like items 2 and 4. This observation was consistent with survey design, in which not every item was written with “strongly agree” being a positive response. The distributions of 22 components within three capital domains, as introduced in the background section, were visualized in Figure 4. The nine components of personal capital had overall higher variability than those in the other two capitals, indicating that clients had more varied thoughts over personal capital components, with “Employment”, “Financial Wellbeing”, and “Housing and Living Situation” being three of the most varied components. “Social mobility” had the least variability among the components, reflecting the fact that clients experienced similar social mobility issues.

Correlations of Subscales. The Cronbach’s of the 9 subscales was 0.88, suggesting that these subscales had relatively high internal consistency. In addition, Spearman correlation matrix of subscales was presented in Table 2. All p values were less than 0.05. While these variables with high intercorrelations could measure one underlying variable, which is called a “factor,” these correlation coefficients were not extremely high which indicates that any two of the variables were measuring slightly different aspects of the “factor.” In addition, inter-factor correlations of the three capitals were conducted and shown in Table 3. These moderate positive relationships with correlation coefficient around 0.5 verified the design of three capitals measuring different aspects of RCI.

Comparison of RCI Responses Based on Demographics. The distributions of RCI against each of the demographic variables were first visualized by the side-by-side boxplots (Figure 5), which illustrated the capability of RCI to capture both similarities and differences among categories of individual variable. For example, RCIs of clients addicted to prescription were overall higher than those of whom addicted to marijuana, while similar to the those in alcohol addiction group. To further examine and quantify the

<table>
<thead>
<tr>
<th>Table 3. Spearman correlation matrix of the three capitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Capital</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td>Personal Capital</td>
</tr>
<tr>
<td>Social Capital</td>
</tr>
<tr>
<td>Cultural Capital</td>
</tr>
</tbody>
</table>
Table 4. Results from Tukey’s test of multiple comparisons of means

<table>
<thead>
<tr>
<th>Primary Addiction</th>
<th>Difference</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>cocaine vs. alcohol</td>
<td>-5.08</td>
<td>-2.52 - 3.06</td>
<td>1.00</td>
</tr>
<tr>
<td>other vs. alcohol</td>
<td>-3.59</td>
<td>-2.17 - 1.02</td>
<td>0.99</td>
</tr>
<tr>
<td>heroin vs. alcohol</td>
<td>-6.76</td>
<td>-3.35 - 3.36</td>
<td>0.99</td>
</tr>
<tr>
<td>marijuana vs. alcohol</td>
<td>-8.70</td>
<td>-4.16 - 4.73</td>
<td>0.41</td>
</tr>
<tr>
<td>methamphetamine vs. alcohol</td>
<td>-8.47</td>
<td>-3.84 - 3.81</td>
<td>0.01</td>
</tr>
<tr>
<td>prescription vs. alcohol</td>
<td>1.38</td>
<td>-1.14 - 2.79</td>
<td>1.00</td>
</tr>
<tr>
<td>other vs. cocaine</td>
<td>1.48</td>
<td>-3.94 - 0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>heroin vs. cocaine</td>
<td>-1.70</td>
<td>-5.40 - 2.00</td>
<td>1.00</td>
</tr>
<tr>
<td>marijuana vs. cocaine</td>
<td>-3.62</td>
<td>-6.96 - 0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>methamphetamine vs. cocaine</td>
<td>-3.39</td>
<td>-6.78 - 0.01</td>
<td>1.00</td>
</tr>
<tr>
<td>prescription vs. cocaine</td>
<td>6.46</td>
<td>-3.85 - 16.73</td>
<td>1.00</td>
</tr>
<tr>
<td>heroin vs. other</td>
<td>-3.19</td>
<td>-6.57 - 0.20</td>
<td>1.00</td>
</tr>
<tr>
<td>marijuana vs. other</td>
<td>-5.10</td>
<td>-10.20 - 0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>methamphetamine vs. other</td>
<td>-4.88</td>
<td>-9.16 - 0.00</td>
<td>0.98</td>
</tr>
<tr>
<td>prescription vs. other</td>
<td>4.97</td>
<td>-1.36 - 11.28</td>
<td>1.00</td>
</tr>
<tr>
<td>marijuana vs. heroin</td>
<td>-1.92</td>
<td>-5.18 - 1.34</td>
<td>1.00</td>
</tr>
<tr>
<td>methamphetamine vs. heroin</td>
<td>-1.69</td>
<td>-3.97 - 0.60</td>
<td>1.00</td>
</tr>
<tr>
<td>prescription vs. heroin</td>
<td>8.16</td>
<td>-1.76 - 17.05</td>
<td>0.98</td>
</tr>
<tr>
<td>methamphetamine vs. marijuana</td>
<td>0.23</td>
<td>-0.01 - 0.46</td>
<td>1.00</td>
</tr>
<tr>
<td>prescription vs. marijuana</td>
<td>10.08</td>
<td>-3.48 - 23.63</td>
<td>0.61</td>
</tr>
<tr>
<td>prescription vs. methamphetamine</td>
<td>9.85</td>
<td>-0.42 - 23.12</td>
<td>0.36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Addiction Identification</th>
<th>Difference</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Struggling vs. NA</td>
<td>-9.61</td>
<td>-26.36 - 7.13</td>
<td>0.37</td>
</tr>
<tr>
<td>In Recovery vs. NA</td>
<td>0.68</td>
<td>-15.84 - 17.20</td>
<td>0.99</td>
</tr>
<tr>
<td>In Recovery vs. Struggling</td>
<td>10.29</td>
<td>5.81 - 14.78</td>
<td>0.00</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Treatment Counseling Status</th>
<th>Difference</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>In treatment, out-patient or individual counseling vs. NA</td>
<td>0.91</td>
<td>-16.22 - 18.04</td>
<td>1.00</td>
</tr>
<tr>
<td>In treatment, residential or in-patient vs. NA</td>
<td>0.53</td>
<td>-18.18 - 19.25</td>
<td>1.00</td>
</tr>
<tr>
<td>Not in treatment or counseling vs. NA</td>
<td>-0.45</td>
<td>-17.58 - 17.67</td>
<td>1.00</td>
</tr>
<tr>
<td>In treatment, residential or in-patient vs. In treatment, out-patient or individual counseling</td>
<td>-0.38</td>
<td>-9.51 - 8.76</td>
<td>1.00</td>
</tr>
<tr>
<td>Not in treatment or counseling vs. In treatment, out-patient or individual counseling</td>
<td>-1.36</td>
<td>-6.53 - 3.80</td>
<td>0.90</td>
</tr>
<tr>
<td>Not in treatment or counseling vs. In treatment, residential or in-patient</td>
<td>-0.99</td>
<td>-10.11 - 8.13</td>
<td>0.99</td>
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</table>

<table>
<thead>
<tr>
<th>Legal Status</th>
<th>Difference</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current legal issues vs. NA</td>
<td>9.31</td>
<td>-9.92 - 28.54</td>
<td>0.59</td>
</tr>
<tr>
<td>Previous legal issues vs. NA</td>
<td>2.66</td>
<td>-19.91 - 25.24</td>
<td>0.99</td>
</tr>
<tr>
<td>No legal issues vs. NA</td>
<td>12.97</td>
<td>-6.21 - 32.15</td>
<td>0.30</td>
</tr>
<tr>
<td>Previous legal issues vs. Current legal issues</td>
<td>-6.65</td>
<td>-19.53 - 6.23</td>
<td>0.54</td>
</tr>
<tr>
<td>No legal issues vs. Current legal issues</td>
<td>3.66</td>
<td>-1.26 - 8.58</td>
<td>0.22</td>
</tr>
<tr>
<td>No legal issues vs. Previous legal issues</td>
<td>10.31</td>
<td>-2.50 - 23.12</td>
<td>0.16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employment</th>
<th>Difference</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time vs. Unknown</td>
<td>2.69</td>
<td>-3.37 - 8.75</td>
<td>0.74</td>
</tr>
<tr>
<td>Other vs. Unknown</td>
<td>-2.07</td>
<td>-11.69 - 7.54</td>
<td>0.98</td>
</tr>
<tr>
<td>Part-time vs. Unknown</td>
<td>0.22</td>
<td>-1.18 - 7.62</td>
<td>1.00</td>
</tr>
<tr>
<td>Unemployed vs. Unknown</td>
<td>-6.91</td>
<td>-13.73 - 0.08</td>
<td>0.05</td>
</tr>
<tr>
<td>Other vs. Full-time</td>
<td>-4.76</td>
<td>-13.24 - 3.71</td>
<td>0.53</td>
</tr>
<tr>
<td>Part-time vs. Full-time</td>
<td>-2.47</td>
<td>-8.32 - 3.37</td>
<td>0.77</td>
</tr>
<tr>
<td>Unemployed vs. Full-time</td>
<td>-9.60</td>
<td>-14.70 - 4.50</td>
<td>0.00</td>
</tr>
</tbody>
</table>
### Table 4. Results from Tukey’s test of multiple comparisons of means

| Employment | Part-time vs. Other | 2.29 | -7.19 | 11.77 | 0.96 |
|           | Unemployed vs. Other | -4.83 | -13.87 | 4.20 | 0.58 |
|           | Unemployed vs. Part-time | -7.13 | -13.76 | -0.49 | 0.03 |
| Income    | Less than $25,000 vs. Unknown | -6.06 | -11.51 | -0.61 | 0.02 |
|           | More than $75,000 vs. Unknown | 8.68 | 0.63 | 16.73 | 0.03 |
|           | $25,000 to $75,000 vs. Unknown | 0.74 | -5.26 | 6.73 | 1.00 |
|           | Decline vs. Unknown | -3.83 | -13.05 | 5.38 | 0.84 |
|           | Unknown vs. Unknown | -1.88 | -11.52 | 7.77 | 0.99 |
|           | More than $75,000 vs. Less than $25,000 | 14.74 | 7.30 | 22.18 | 0.00 |
|           | $25,000 to $75,000 vs. Less than $25,000 | 6.80 | 1.65 | 11.94 | 0.00 |
|           | Decline vs. Less than $25,000 | 2.23 | -6.46 | 10.91 | 0.98 |
|           | Unknown vs. Less than $25,000 | 4.18 | -4.96 | 13.33 | 0.77 |
|           | $25,000 to $75,000 vs. More than $75,000 | -7.94 | -15.79 | -0.10 | 0.05 |
|           | Decline vs. More than $75,000 | -12.51 | -23.03 | -2.00 | 0.01 |
|           | Unknown vs. More than $75,000 | -10.56 | -21.45 | 0.34 | 0.06 |
|           | Decline vs. $25,000 to $75,000 | -4.57 | -13.60 | 4.46 | 0.69 |
|           | Unknown vs. $25,000 to $75,000 | -2.61 | -12.09 | 6.86 | 0.97 |
|           | Unknown vs. Decline | 1.96 | -9.82 | 13.73 | 1.00 |
| Education | No diploma vs. Unknown | -5.93 | -14.87 | 3.01 | 0.43 |
|           | Post-secondary degree vs. Unknown | -3.02 | -11.52 | 5.48 | 0.94 |
|           | Decline vs. Unknown | -2.24 | -16.29 | 11.82 | 1.00 |
|           | Advanced degree vs. Unknown | -2.04 | -12.65 | 8.58 | 1.00 |
|           | High school diploma, or equivalent vs. Unknown | -8.60 | -17.38 | 0.18 | 0.06 |
|           | Some college, no degree vs. Unknown | -7.97 | -16.82 | 0.67 | 0.09 |
|           | Post-secondary degree vs. No diploma | 2.91 | -4.03 | 9.85 | 0.87 |
|           | Decline vs. No diploma | 3.69 | -9.48 | 16.87 | 0.98 |
|           | Advanced degree vs. No diploma | 3.89 | -5.52 | 13.31 | 0.88 |
|           | High school diploma, or equivalent vs. No diploma | -2.67 | -9.95 | 4.62 | 0.93 |
|           | Some college, no degree vs. No diploma | -2.04 | -9.17 | 5.08 | 0.98 |
|           | Decline vs. Post-secondary degree | 0.78 | -12.09 | 13.66 | 1.00 |
|           | Advanced degree vs. Post-secondary degree | 0.98 | -8.01 | 9.97 | 1.00 |
|           | High school diploma, or equivalent vs. Post-secondary degree | -5.58 | -12.31 | 1.15 | 0.18 |
|           | Some college, no degree vs. Post-secondary degree | -4.95 | -11.51 | 1.60 | 0.27 |
|           | Advanced degree vs. Decline | 0.20 | -14.16 | 14.56 | 1.00 |
|           | High school diploma, or equivalent vs. Decline | -6.36 | -19.42 | 6.70 | 0.77 |
|           | Some college, no degree vs. Decline | -5.74 | -18.71 | 7.24 | 0.84 |
|           | High school diploma, or equivalent vs. Advanced degree | -6.56 | -15.82 | 2.70 | 0.35 |
|           | Some college, no degree vs. Advanced degree | -5.94 | -15.07 | 3.20 | 0.46 |
|           | Some college, no degree vs. High school diploma, or equivalent | 0.62 | -6.29 | 7.54 | 1.00 |
uneven distributions of RCIs within categories of these variables, we performed pairwise comparison using Tukey’s test of multiple comparisons, (results shown in Table 4). The pairs of categories within each variable were underlined if their means were significantly different (p value < 0.05) from each other in Table 4. If any of the pairs were different, we concluded that the corresponding variable was significantly associated with RCI. Overall, the variables that were significantly associated with RCI are: primary addiction, addiction identification, employment, and income.

**Discussion**

The RCI is an innovative tool, which is now a validated instrument based on this research, that was developed in South Dakota, a state that is no stranger to innovations in the alcohol and drug space. In 2005, the state of South Dakota implemented use of twice daily breathalyzers for DUI offenders. During the first five years of the program that included “swift, certain, and modest sanctions for violations,” repeat DUI arrests were reduced by 12 percent.\(^1\) The RCI measures what it is supposed to measure and accurately describes the current state of recovery for the individual taking the assessment. The results of the validation steps taken so far have also provided FIT with the information needed to further define its instrument implementation structure.

There are numerous screening tools specifically designed to identify the presence or risk of alcohol or other drug addiction. Many of these tools have been standardized and used across clinical settings. Because the recovery or wellness journey is not generally managed or monitored in the same clinical proximity or interest, no tools have emerged to measure addiction wellness. As addiction care continues to be integrated into mainstream healthcare and chronic disease management programs, such an instrument or standard will be required to ensure the tracking of outcomes in an outcomes-driven reimbursement system.

The most prominent manifestation of the disease of addiction is the use of a substance. Clinical trials for community and clinical-based interventions largely focus on the use or non-use of a substance as the primary success indicator for that modality – essentially ignoring myriad of symptoms associated with the illness. If interventions continue to be designed and delivered to cease use, individuals will see use or non-use as the beginning and the ending of addiction wellness. As the ASAM definition of addiction\(^6\) and SAMSHA definition of recovery\(^1\) clearly indicate, addiction and addiction wellness have significantly more relevant variables. The RCI provides the holistic measurement that is relevant at any point in the continuum of care (e.g., before or after clinical care). The RCI is designed to give the provider of care (clinical or peer) momentary assessments of a person’s addiction wellness, as well as a longitudinal perspective when administered over a long period of time. More importantly, the instrument allows the provider and person impacted by the disease to focus on areas of that person’s life that need new or continued attention.

Since beginning this validation project, FIT has modified its protocol for administering the RCI along with another instrument that measures risk for clients. By administering these instruments on the same day, we believe we can move forward with validating the predictive nature of the RCI to determine if it will measure behavior change (e.g., increased connectedness, decreased legal issues, harm reduction, increased hopefulness, etc.). FIT intends to move forward with shortening the instrument length after we further our validation work. We also intend to use the instrument – short or long form – in combination with previous RCI responses, intervention activity, demographic data, and natural language from other communication to prescribe interventions (including intensity), establish coaching plans, and predict outcomes (as determined by previous performance of similar clients). Looking to the future, we will continue to explore opportunities to publish results of our validation activities as an effort to build on the addiction-related body of knowledge.

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About the Authors:
David Whitesock, JD/MA, Chief Innovation Officer, Face It TOGETHER, Inc., Sioux Falls, South Dakota.
Jing Zhao, PhD, Assistant Research Scientist, Sanford Research, Sioux Falls, South Dakota, Assistant Professor, Internal Medicine, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota.
Kristen Goettsch, MA, Senior Evaluation Scientist, Face It TOGETHER, Inc., Sioux Falls, South Dakota.

Jessica Hanson, PhD, Assistant Scientist, Sanford Research, Sioux Falls, South Dakota; Assistant Professor, Obstetrics and Gynecology, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota.

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Introduction

Discharges against medical advice (AMA), known as ‘self-discharge,’ occur when an inpatient decides to leave the hospital before the end of treatment and against the recommendation of medical providers. Patients choosing to terminate their hospital stay against medical advice are at risk for future health complications. Yet, the prevalence of patient self-discharges is relatively high, accounting for 2 percent of all hospital discharges. In previous studies, the patients who leave AMA tend to be younger, non-white males with a lower income. Interestingly, about 20 percent of the patients that self-discharged did so numerous times, accounting for over 40 percent of all AMA incidences. The most common feature for self-discharge was a diagnosis of a mental health disorder, especially substance abuse, while those with cancer were the least likely to leave AMA.

Generally, individuals that choose to self-discharge are at a higher risk for adverse health outcomes in both morbidity and mortality. These patients have a 20-40 percent increase of readmission with further increased risk if
co-morbidity is present (e.g., alcohol abuse, asthma, HIV). Unfortunately, many of these patients are readmitted with worsening symptoms compared to the initial visit, leading to a 40 percent increased yearly mortality rate after self-discharge. Given the increase in mortality and morbidity after leaving AMA, the financial burden placed on the patient can be extreme with the added stigma attached that can worsen their access to health care in the future.

Unfortunately, few models are available to predict which patients may leave AMA. Although previous data have identified several factors associated with leaving AMA, existing literature have not explored if socioeconomic factors play a role in leaving AMA. This article attempts to address these gaps by examining income levels and insurance status to identify patients who are potentially at risk for leaving against medical advice. By identifying these patients early in the process, it is entirely possible to address downstream morbidities and take preventative measures to avoid future early voluntary discharges.

**Design and Methods**

This project utilized the 2012 data from the National Inpatient Sample (NIS) from the Healthcare Cost and Utilization Project (HCUP), funded through the Department of Health and Human Services Research and Quality, and operated through the Agency for Healthcare Research and Quality. The NIS draws from the 44 states that participate in HCUP, accounting for 4,378 hospitals, which amounts to 95 percent of the U.S. population. Analyzing over seven million hospital stays, the NIS database is the largest in the U.S., and based on validated method of weights. The database contains standardized data through diagnosis/procedure codes, hospital characteristics, and patient populations. The HCUP database has validated through numerous peer-reviewed studies.

We analyzed the data specific to adults over the age of 18. Both patient characteristics and hospital characteristics are including in the HCUP-NIS database. Our primary outcome of interest was discharge type (AMA versus non-AMA). To assess socioeconomic status (SES), we examined primary payer type (Medicaid, Medicare, private payer, uninsured, other) and median household income quartiles for the patient’s ZIP code (Table 1). Potential confounding variables accounted for in the analysis include patient characteristics: sex (male, female), race (white, black, Hispanic, other), age, and severity of illness, and hospital characteristics: region (Northeast, South, Midwest, and West), bed size (small, medium, large), and location/teaching status of the hospital (rural, urban non-teaching, urban teaching).

All analysis was performed on the weighted discharges and descriptive statistics were calculated for all primary variables and confounders using Proc Surveylogistic. The association between SES factors and discharge type was assessed using multivariate logistic regression after adjustment for possible confounders. In addition to the initial analysis comparing AMA to all other discharge statuses, we also performed a sensitivity analysis to examine differences in SES between discharges for AMA and regular discharges since other discharge categories may not include those able to leave AMA (e.g., deaths, discharge to another institution). Statistical significance set at p < 0.05. All analysis was performed in SAS version 9.4 (SAS Institute).

**Results**

Patients leaving against medical advice were assessed based on different factors, including gender, insurance status, income percentile, and ethnicity. In leaving AMA, men were at an increased risk of leaving AMA (ORad = 3.82).
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2.617, 95 percent CI: 2.545-2.691; p<0.001) compared to the female population. With private insurance as the comparison, individuals that self-pay had the highest odds of self-discharge (Figure 1). Patients in this category had four times the odds of leaving against medical advice (OR$_{adj}$ = 4.16, 95 percent CI: 3.96-4.36; p<0.001) compared to the private insurance group. Medicare patients had double the risk (OR$_{adj}$ = 2.10, 95 percent CI: 2.02-2.19; p<0.001), while Medicaid patients had close to triple to risk (OR$_{adj}$ = 2.94, 95 percent CI: 2.81-3.08; p<0.001) of these self-discharges in an inpatient setting. Although insurance status was a key factor in leaving AMA, other characteristics in an inpatient setting played a significant role in self-discharges.

Patients in the higher income percentile bracket had lower odds of leaving against medical advice. In comparison to the lowest income percentile (0-25th percentile), those in the 26th-50th percentile were 20 percent less likely to leave against medical advice (OR$_{adj}$ = 0.80, 95 percent CI: 0.77-0.83; p<0.001). As income increases, the risk of leaving an inpatient setting without physician agreement decreases. Those in the 51st-75th income percentile had a 30 percent decrease in leaving AMA (OR$_{adj}$ = 0.68, 95 percent CI: 0.65-0.72; p<0.001), while patients in the 76th-100th income percentile had the lowest risk AMA (OR$_{adj}$ = 0.62, 95 percent CI: 0.58-0.66; p<0.001) (Figure 2).

Ethnicity played a predictive role in leaving against medical advice. In comparison to white patients, there was no significant different in black patients (OR$_{adj}$ = 1.023, 95 percent CI: 0.982-1.066; p = 0.2688) and Native Americans (OR$_{adj}$ = 0.994, 95 percent CI: 0.87-1.136; p=0.9322) in leaving against medical advice. However, the Hispanic (OR$_{adj}$ = 0.665, 95 percent CI: 0.613-0.721; p<0.001) and Asian/Pacific Islander (OR$_{adj}$ = 0.56, 95 percent CI: 0.509-0.615, p<0.001) inpatient population had a decrease risk in self-discharges compared to white patients (Figure 3).
Discussion

This study identified several socioeconomic factors that had significant impact on those leaving AMA. Individuals with Medicare or Medicaid insurance had a higher risk of leaving against medical advice than those compared to private insurance. Not surprisingly, those that lacked insurance completely also had increased odds of leaving against medical advice. This is not entirely surprising since out of pocket expenses can reach astronomical proportions without insurance. However, it is interesting to note that individuals on government insurance, Medicare or Medicaid, were also at risk in leaving against medical advice. Similarly, patients from ZIP codes with higher median incomes had significantly lower chances of leaving against medical advice compared to those in the lowest percentile (0-25th). The data is consistent with previous reports that suggested the importance of socioeconomic status and hospital stays. Leaving against medical advice has been previously associated with young, mentally ill patients discharged from hospitals in the Northeast, but with the changing health care climate and changing insurance accessibility for patients, understanding the importance of socioeconomic status on why patients leave AMA must be further investigated.

Although the reasoning behind leaving AMA based on insurance status are not well-understood, the increasing prevalence of chronic conditions, patients living longer, and increased out of pocket costs may play significant roles. Even though Medicare has shown to dramatically decrease out of pocket costs in lower income beneficiaries, life threatening and chronic illnesses, especially those that require longer hospital stays, can lead to financial insecurity. Despite out of pocket spending being generally lower for those with Medicare or Medicaid, previous studies observed a positive association between out of pocket spending and chronic conditions for Medicaid beneficiaries for those in the below-poverty bracket. In those uninsured, there was an observed 300 percent increased odds of leaving AMA, accounting for 18 percent of patients that self-discharge. Interestingly, it is the private insurance group, especially the employer-sponsored insurance, which had the largest out of pocket share of health care expenditures (42.7 percent), while those that were uninsured had the least (7.2 percent). One possible explanation is that the absolute amount of out of pocket payment impacts more than the relative ratio of spend. Relative out of pocket costs ($100) has more psychological impact for those uninsured or with lower income as compared to those employed or with insurance) on top of chronic illnesses may lead to increased self-discharges to avoid further financial burdens.

Patients that self-discharge are at a higher risk for adverse outcomes, resulting in additional side effects that could compound their illness. Readmission rates were significantly higher, patients were observed to be 20-40 percent more likely to be readmitted by the second week with an overall increased risk of mortality. In fact, the largest hazard for both readmission and mortality in a 30-day period was determined if the patient had left against medical advice. However, it must be noted that the consequences also affect the physician-patient relationship. Physicians' attitudes towards patients can result in a lower quality of care due to the perceived bad behavior from prior self-discharges leading to a cycling effect of future AMA events. For instance, patient perception of provider negativity can be so profound that 25 percent of patients did not return for follow-up care after self-discharge because of their worry over angering the clinicians. Consequently, this leads to a decrease in overall quality of care with decreased access to health care and possible increase of future self-discharges. In addition, physicians face ethical concerns when patients express their desire to leave AMA. Though the choice to self-discharge is within the bounds of a competent patient's decision making, in honoring a patient's autonomy, physicians may feel conflicted due to their ethical obligation to prevent harm and act in a beneficent manner. In these instances, clear communication between the patient and physician, including costs and benefits of care, is essential to ensure the patient's welfare while respecting their autonomy. In order to support the patient's autonomy, the physician must be educated on the reasons as to why the patient chooses to self-discharge. In one study, two-thirds of patients identified personal and financial obligations as the main purpose for self-discharge. Not surprisingly, there are a multitude of reasons for self-discharge, including the influences of socioeconomic status, that a physician should aware in order to provide the best care possible.

Previous research examined different factors such as mental health disorders and substance abuse as influences in patient self-discharges, yet the rate of those leaving AMA continues to persist, holding steady for the last ten years. Even with understanding different patient choices, fixing the problem is a multi-faceted, time-consuming endeavor with no small amount of financial
burdens to both the hospital and patient. Certainly, communication between the physician and patient is an important key step to decreasing self-discharges. The focus on patient education and strategies targeted through understanding of SES may serve to improve AMA prevention strategies.

There are certain limitations that are not addressed in this study. Interestingly, through the advent of the Affordable Care Act, millions of Americans now have access to insurance, which could alter the data in the years following the 2012 data set. Future research should work to determine if current research trends continue. Leaving AMA is a multi-faceted, dynamic issue that cannot be addressed in a singular environment, but must be examined from numerous viewpoints that can include, among others, an individual’s socioeconomic status to the physician mindset to hospital resources. Additionally, this project does not breakdown the regions and hospital type in leaving AMA. There could be significant differences in self-discharges in New York vs. South Dakota, an urban teaching hospital in Denver, Colorado, versus a rural community hospital in Philip, South Dakota. Future directions of this project would examine self-discharges at different regions and in various hospital settings.

Conclusion
This project examined the importance of socioeconomic factors in leaving against medical advice in an inpatient adult population. Previous research has examined specific disease types in self-discharges, but this study addresses existing gaps in research by investigating the impact of insurance status and income level, allowing for a broader scope of understanding this problem. Although leaving AMA is multi-faceted, targeting these socioeconomic factors may provide hospitals a starting point to address self-discharges without draining numerous resources. Understanding the socioeconomic reasons for leaving AMA allows for early identification in time for health care providers to stratify the risks and intervene earlier rather than later. Preventing all patients from self-discharges is not feasible, however, reducing even a small amount could have impact on decreasing morbidity and mortality.

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About the Authors:
Sharleen Yuan, BA, MA, PhD, MSIV, University of South Dakota Sanford School of Medicine, Vermillion, South Dakota.
Sarah Ashmore, BS, MSIV, University of South Dakota Sanford School of Medicine, Vermillion, South Dakota.
Kauhal R. Chaudhary, MS, Center for Health Outcomes and Prevention Research, Sanford Research, Sioux Falls, South Dakota.
Benson Hsu, MD, MBA, FAAP, Children’s Health Research Center Sanford Research Sioux Falls, South Dakota; Departments of Pediatrics and Internal Medicine University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota.
Susan E. Puumala, PhD, Departments of Pediatrics and Internal Medicine, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota; Center for Health Outcomes and Prevention Research, Sanford Research, Sioux Falls, South Dakota.

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It’s Crowded Here – A Case of Cor Triatriatum Sinister

By Shahbaz Ali Malik, MD; Samer Sayyed, MD; and Gregory Pavlides, MD, PhD

Abstract

The image presented is a still frame taken from a transesophageal echocardiogram of a 76-year-old male who was referred for evaluation of mitral valve disease. He was found to have a non-flow limiting membrane, dividing the left atrium into two sections, consistent with the diagnosis of cor triatriatum sinister.

A 76-year-old male was referred to our cardiology clinic for evaluation of mitral regurgitation. He had a history of atrial fibrillation treated with rivaroxaban, but no known coronary artery disease, stroke or heart failure. The patient denied chest pain or shortness of breath and only endorsed occasional palpitations.

Electrocardiography was performed and revealed atrial fibrillation. A transthoracic echocardiogram was remarkable for severe dilation of the left atrium with only mild to moderate mitral regurgitation. The left ventricle was normal in size and function. A membranous structure was also visualized within the left atrium so transesophageal echocardiography (TEE) was pursued to better define left atrial anatomy. TEE confirmed the presence of a funnel type, thin, non-flow restrictive membrane dividing the left atrium into two sections - consistent with cor triatriatum sinister (CTS). The CTS originated from the anterior, lateral, and dorsal aspects of the left atrium. A still image from the TEE is shown in Figure 1. The patient and treating physicians were unaware of this diagnosis despite multiple echocardiograms performed previously. Given lack of significant symptoms, he was managed conservatively.

Cor triatriatum is an exceedingly rare condition found in less than 0.1 percent of clinically diagnosed cardiopathies. The condition was first described by Church in 1868 but the name “cor triatriatum” is attributed to Borst in 1905. Echocardiography is a noninvasive imaging modality that can accurately elucidate this condition. Cor triatriatum involves the presence of a fibromuscular septum in either of the atria, dividing the chamber further into two sections, which further communicate via a defect in the membrane. When involving the left atrium, the condition is referred to his cor triatriatum sinister. When the right atrium is involved, which is rare, it is referred to as cor triatriatum dexter. Treatment is usually dictated by the presence of symptoms such as exertional dyspnea, orthopnea, and hemoptysis. Surgical intervention is typically indicated in symptomatic individuals with a hemodynamically significant intra-atrial flow obstruction akin to that of mitral stenosis, but with a morphologically normal mitral valve.

Figure 1. Transesophageal echocardiogram image showing the left ventricle (LV), aortic valve (AV), left atrium (LA), mitral valve (MV) and a membrane in the LA dividing it into two chambers.

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About the Authors:

Shahbaz Ali Malik, MD, PGY-V, Cardiovascular Disease Fellow, University of Nebraska Medical Center, Department of Internal Medicine, Division of Cardiology, Omaha, Nebraska; Sanford USD Medical Center, Sioux Falls, South Dakota.

Samer Sayyed, MD, University of Nebraska Medical Center, Department of Internal Medicine, Division of Cardiology, Omaha, Nebraska.

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Acute Hemolytic Transfusion Reaction Due to Anti-Kpa Antibody

By Ashwnna Sunasse, MD; Jessica Mackey, MD; Keith A. Anderson, MD; and Mark K. Huntington, MD, PhD

Abstract

Background: Kpa (KEL3, Penney) is a red blood cell antigen within the Kell system, first described in 1957, that occurs in less than 2 percent of the population. Although anti-Kpa antibodies were identified in 2-5 percent of those with alloantibodies among patients requiring chronic transfusion, only five previously published case reports of anti-Kpa reactions were identified.

Case Report: Reported here is a case of an elderly female who experienced an acute hemolytic transfusion reaction due to this antigen. Following initiation of blood transfusion, she experienced a sudden onset of rigorous chills, accompanied by elevated temperature, tachycardia, and hypertension. Laboratory studies showed uremia, elevated creatinine, positive direct Coomb's, and low haptoglobin. Serology revealed anti-Kpa antibody.

Conclusion: This report is only the sixth, to our knowledge, of a significant reaction attributable to anti-Kpa and only the second of an acute hemolytic reaction associated with it. It serves as a reminder of the potential of low incidence antigens causing severe reactions; this potential should be considered when evaluating acute hemolytic reaction.

Introduction

Kpa is a low incidence red blood cell antigen, to which have rarely been attributed significant transfusion reactions. We report here a case of an elderly female who experienced an acute hemolytic transfusion reaction due to this antigen and review the literature for similar cases.

Case Presentation

An 84-year-old white female presented to a small rural hospital following a fall. An intertrochanteric femur fracture was identified and she was transferred to our referral hospital for operative management. Past medical history was significant for B-cell lymphoma and melanoma. The patient had recently ended a course of chemotherapy for the latter, which had resulted in pancytopenia. Hemoglobin on admission was 7.6 g/dL.

Following surgery, her hemoglobin dropped to 5.4 g/dL and she was given a transfusion of a single unit of leukoreduced packed red blood cells postoperatively. The next day, another unit was infused; two hours after initiation, she experienced a sudden onset of rigorous chills. Her temperature increased from 36.8 to 37.4 degrees C, pulse increased to 150 beats/minute and blood pressure increased from 117/70 to 160/119 mmHg. The transfusion was stopped immediately and the transfusion reaction protocol initiated. Diphenhydramine and labetolol were administered. Symptoms resolved.

Laboratory testing following the reaction revealed normal direct bilirubin of 0.5 mg/dL, increased blood urea nitrogen to 52 mg/dL, increased serum creatinine to 2.52 mg/dL, positive direct Coomb's test, and low haptoglobin at less than 6 mg/dL. Our facility's standard transfusion reaction workup, begun immediately following notification from nursing, included a clerical check, visual examination of pre- and post-transfusion serum, repeat ABO and Rh typing and direct antiglobulin testing (DAT) of pre- and post-transfusion specimens. No clerical discrepancies were identified, the pretransfusion serum was clear while the posttransfusion serum showed moderate hemoglobinemia. The pre and post cell typings both showed group A Rh positive cells. The pretransfusion DAT was negative and
the posttrasfusion DAT was 3 plus positive for both IgG and C3d. An immunoglobulin crossmatch of the pretransfusion specimen against the second transfused unit was 3 plus positive in the antiglobulin phase. These findings confirmed the presence of an antibody to a low incidence red cell antigen that was not detected by the immediate spin crossmatch performed prior to transfusion.

During the remainder of the patient’s hospitalization, she received two additional red cell transfusions, crossmatched using an antiglobulin technique, with no adverse effects. She was discharged on hospital day seven to a swing bed in her hometown to continue rehabilitation for the hip fracture.

The patient’s serum was subsequently referred to a reference laboratory which confirmed the presence of anti-Kpa antibody. The initial antibody screening cells did not express Kpa antigen, a common situation for a low incidence antigen.1

Discussion

Kpa (KEL3, Penney) is a low frequency antigen within the Kell system, first described in 1957, that occurs in approximately 2 percent of the population.2-4 Anti-Kpa antibodies can be produced after exposure to the Kpa antigen by previous transfusion or pregnancy. Although among patients requiring chronic transfusions anti-Kpa antibodies were identified in 2-5 percent of those with erythrocyte alloantibodies,5 only five case reports of anti-Kpa related reactions were identified when “anti-Kpa”, “KEL3”, “Kell Penney”, or “Kell Kpa” were used as search terms in querying the PubMed database (www.ncbi.nlm.nih.gov/pubmed/). These included severe delayed hemolytic transfusion reactions;6 an acute extravascular hemolytic reaction,8 and three reports of alloimmunization hemolytic disease of the fetus and newborn.911 Given the overall dearth of case reports, it may be reasonably inferred that most of the reactions caused by anti-Kpa are very mild and require no intervention.9

The protocol in our blood bank after finding group and type specific blood is to perform a two-cell antibody screen with immediate spin cross-matching if the antibody screen is negative. Many other institutions perform computer assisted electronic cross-matches in patients who have had a prior negative antibody screen and no history of clinically significant antibodies.12 Both of these techniques may potentially miss antibodies to low incidence antigens because the cells used in the screen may not carry the corresponding antigens.13

How might these reactions be prevented? Studies have shown that the risk of a hemolytic transfusion due to a low frequency antigen is approximately 1 per 250,000 crossmatches using these methods. However, the same studies reported that very few of these reactions resulted in significant harm to the patient.1214 Further, the limited clinical significance of these antibodies is implied by the absence of these antigens in the Food and Drug Administration’s listing of which antigens must be present on screening cells. Performing antiglobulin crossmatches as part of the routine work up could avoid most such reactions. However, this approach but would increase – testing cost (approximately $25,000 for 10,000 crossmatches performed annually at our facility – which extrapolates to over $28 million per year nationwide at the current rate of blood usage15). More importantly, this approach would lengthen the time needed to prepare compatible blood for patients by at least 30-45 minutes, which is not acceptable for patients in urgent need of transfusion. The net effect would be more harm than benefit. Another option as postulated by Padmore et al is to include low incidence antigens in the antibody screening cells.9 Screening cells are typically procured from commercial vendors and adding cells with these antigens would also increase cost.

Conclusion

This report is only the sixth, to our knowledge, of a significant reaction attributable to anti-Kpa and only the second of an acute hemolytic reaction associated with it. The case serves as a reminder of the potential of low incidence antigens causing severe reactions; current compatibility testing has gaps through which rare events will fall. One must be ever vigilant for the unexpected.

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About the Authors:
Ashwyna Sunassee, MD, Department of Pathology, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota.
Jessica Mackey, MD, Department of Family Medicine, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota; Center for Family Medicine, Sioux Falls, South Dakota.
Keith A. Anderson, MD, Department of Pathology, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota; Sanford Health, Sioux Falls, South Dakota.
Mark K. Huntington, MD, PhD, Department of Family Medicine, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota; Center for Family Medicine, Sioux Falls, South Dakota.

May 2018 223
An Evaluation of SPOT Vision Screening Efficacy for Children in South Dakota

By Jed H. Assam, MD, MS; Tanner Ferguson, BS, MSIV; Nicole West, BS, MSIV; and Terrence S. Spencer, MD

Abstract

Background: Amblyopia is a preventable, sight stealing disorder with a prevalence of approximately 2-4 percent in the U.S. pediatric population. Identifying efficacious, early stage screening modalities is of critical importance to sustain quality of vision and quality of life. This project assessed the quality of screening methods used in the Children’s Vision Screening Initiative (CVSI), administered by Northern Plains Eye Foundation in collaboration with Western South Dakota Lions Clubs, by comparing to data collected in follow-up appointments at professional eye care clinics.

Methods: Data from 120 cases for children ages 6 months-12 years collected between February 2014 to July 2016 were compared. Only cases that had undergone initial screening by CVSI using a SPOT photoscreener device and that attended a subsequently scheduled eye care professional referral follow-up appointment were evaluated. SPOT screening performance measures on detecting amblyopia risk factors and the accuracy of refractive error data were evaluated.

Results: Review of professional evaluations showed that 23 percent of cases referred by SPOT screening had detectable amblyopia and 82 percent of all cases referred were found to be in need of further therapy as a result of examination findings. The SPOT device showed fair sensitivity and good specificity in the detection of astigmatism (76 percent/86 percent), strabismus (50 percent/96 percent), and anisometropia (75 percent/90 percent).

Conclusion: Vision screening performed using the SPOT device represents a valuable modality that is easily employable and can provide tremendous benefit to children in the state of South Dakota.

Background

Amblyopia is a preventable, sight stealing disorder for younger age groups. Various studies report the prevalence of amblyopia in the U.S. pediatric population to be approximately between 2-4 percent.1-4 This is suspected to be disproportionately increased in rural areas where there is reduced access to health care.5 South Dakota is a state where finding ways to improve health care access to rural populations is a priority. Yet, it represents one of only eight states (Arkansas, Hawaii, Idaho, Montana, North Dakota, South Carolina, New Hampshire) that does not have a designated pediatric vision screening policy.6 Amblyopia is commonly stratified into three main categories that include strabismic, refractive, and stimulus deprivation (congenital cataract, corneal opacity, etc.).7,8 Strabismus and refractive error (anisometropia or ametropia) tend to be more commonly seen disorder causes for amblyopia with strabismus being identified as the primary cause in approximately 50 percent of unilateral amblyopia cases.7 Other contributing risk factors include child congenital (maternal use of alcohol, drugs, or smoking during pregnancy; premature birth; small for gestational age) and development (developmental delay) history as well as family history of a first degree relative. There are many options for addressing risk factors in
amblyopia and therapy choice depends greatly on the primary cause identified. The end goal of management is to achieve improvement in visual acuity which may be addressed in a stepwise strategy of (1) addressing potential causes of visual deprivation, (2) visually significant refractive error correction, and (3) promoting use of the amblyopic eye. These may be achieved through many methods including optical correction, patching, pharmacological or optical penalization, surgery, and vision therapy techniques.\textsuperscript{1,6}

Amblyopia can be readily prevented during a child’s early developmental years and is easily treated prior to age 5. Beyond this age cap a decline in intervention efficacy has been found to occur.\textsuperscript{1,6} Therefore identifying efficacious, early stage screening modalities is of critical importance to sustain quality of vision and quality of life for patients into their later years.

Autorefractors (photoscreeners) represent a great advancement in the area of pediatric vision screening. Their use has been endorsed by numerous agencies including the U.S. Preventative Task Force, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and the American Association of Certified Orthoptists.\textsuperscript{7} In the last decade, photoscreeners have been employed successfully and with increasing frequency by several countries evaluating children for risk factors of amblyopia.\textsuperscript{2,10} Further, a number of studies evaluating the efficacy of the SPOT photoscreener in detecting amblyogenic risk factors have found this device to be of valuable use as a screening modality.\textsuperscript{11-14}

This study represents a continuation of initial efforts performed in the study by Terveen et al.\textsuperscript{1} that seeks to inspect the efficacy of screening-generated referrals obtained using the SPOT photoscreener. The goal of this project is to provide an age-based comparison of screening data collected as part of the Children’s Vision Screening Initiative (CVSI), which is administered by Northern Plains Eye Foundation (NPEF) in collaboration with the Western South Dakota Lions Clubs. The primary objective of this study is to compare the accuracy of refractive measurements obtained by the SPOT photoscreener during routine NPEF CVSI screening efforts to those obtained in professional eye care clinics using cycloplegic refraction methods. The accuracy of potential conditions listed by the SPOT device to reflecting the actual diagnosis realized on professional follow-up will also be inspected. Secondary objectives are to assess the study population demographics and assess the benefits to screening based on subject outcomes from provider referral appointments.

**Materials and Methods**

**Study Design**

Institutional Review Board approval was obtained from The University of South Dakota Sanford School of Medicine, and the study conforms to the requirements of the U.S. Health Insurance Portability and Accountability Act of 1996. Data from the 120 cases collected between February 2014 to July 2016 was evaluated for children that had (1) been screened positive for one or more risk factors in an initial SPOT screening by CVSI and (2) also attended a subsequent professional referral follow-up appointment. The data compared was from inputs generated by Vision Screening Summary reports obtained using the SPOT photoscreener device and data from Eye Care Professional Evaluation Forms (PEF) completed by eye care professionals in South Dakota who were referred children deemed at risk through preliminary CVSI SPOT screening outcomes.

The process of data collection allowed for inclusion of children ages 6 months through 12 years to whom CVSI free vision screenings were administered by NPEF’s non-medical staff and Lions Clubs volunteers associated with NPEF’s CVSI project. Screening was carried out on an annual basis during the collection period of this study in 6 different communities of the Black Hills region (Rapid City, New Underwood, Custer, Piedmont, Sturgis, and Whitewood). NPEF is a non-profit 501(c)(3) organization, based in Rapid City, South Dakota, whose mission is to protect and preserve vision and restore sight for people of the Northern Plains. Through CVSI, NPEF strives to make vision screenings accessible to children across the region, leading to timely diagnosis and appropriate intervention. All NPEF staff and Lions Clubs volunteers underwent background checks and formal CVSI training on the techniques of vision screening and how to properly administer screenings using the SPOT device. All Lions Clubs volunteers were proctored by experienced staff of NPEF. CVSI follows an established process for administering the screenings, wherein standardized CVSI Free Vision Screening Consent Forms, provided by CVSI, must be completed, signed, and dated by the parent/guardian prior to their child’s free vision screening and only those children with completed, signed, and dated consent forms
are allowed to be screened by CVSI. All SPOT Vision Screening Summary results are compiled by CVSI and information, inclusive of the SPOT Vision Screening Summary result, is mailed to the parent/guardian at the address provided on their child’s consent form. In all cases wherein a complete eye exam was recommended on the SPOT Vision Screening Summary, additional information was provided by CVSI to the parent/guardian on the condition(s) cited from the SPOT Vision Screening Summary result printout report. This, along with available regional eye care professionals, instructions on scheduling an appointment, support agencies providing financial assistance for families in need, and an PEF, is given to the parent/guardian who is then instructed to give it to their eye care professional at the time of the child’s eye exam appointment. After a child is seen by an eye care professional, the provider is encouraged to fill out the PEF and forward it to NPEF.

Device and Procedures

The SPOT photoscreener (Welch Allyn, Co.), Figure 1, is a handheld device that was introduced in 2011 as a vision screening tool able to be easily employed by both professional and layperson alike. It works through harnessing a patient’s optical reflex using infrared photoemissions to obtain binocular refractive errors along with pupillary and gaze measurements. All measurements may be obtained on the device without any need for cycloplegia or pupillary dilation. The reported accuracy by Welch Allyn for various refractive error measurements on the SPOT photoscreener is ±0.25-0.50D for sphere, ±0.50-1.00D for cylinder, and ± 5 degrees for cylinder axis.

To perform an assessment, subjects are placed approximately 1 meter from the device, which harnesses attention through a series of noises and random visual patterns, as a sequence of measures are obtained in multiple meridians in the course of a few seconds. The device can be easily programmed to evaluate for operator designated cut-off values to assist in the decision process for making a referral. It additionally hosts a very user-friendly manner of data presentation on a 4.5-inch touch screen display that may be stored on the device or wirelessly sent to either a printer or other medium of electronic storage for data integration into an Excel-based format.

Data Analysis/Statistics

Descriptive statistics were utilized to stratify and assess patient population demographic information evaluated in this study. SPOT screening performance measures of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic odds ratio (DOR) were determined on the detection capabilities for three key ambyopic risk factors (strabismus, astigmatism, and anisometropia).

In order to compare refractive error data quality between SPOT screening field results and PEFs where cycloplegic refraction technique was used, the univariate measures (sphere, cylinder, axis) were transformed into power vector notation detailed by Thibos et al.\textsuperscript{15} using a spreadsheet calculation methodology described by Miller.\textsuperscript{16} The conversion to vector notation permits the representation of a spherocylinder lens as a single point in three-dimensional dioptric space with the three axes corresponding to separate lens powers. These representative lens powers include the spherical equivalent (M) and two Jackson cross-cylinder lenses at 0 degrees (J\textsubscript{0}) and 45 degrees (J\textsubscript{45}). Such conversion renders the standard clinical notation of refractive measurements using a spherocylindrical format of S/C x A where S (sphere), C (cylinder), and A (axis) to a form that has been proven amenable for performing statistical analysis.\textsuperscript{15-19}

Once data had been converted to power vector form, the 95 percent confidence interval (CI) was generated on the means for SPOT and PEF refractive error vector data (M, J\textsubscript{0}, J\textsubscript{45}) for both the right and left eye using a T distribution. Additionally, the calculated probability using a two-tailed T test of means was also computed to detect for difference between refractive error measurements.

Results

Of the 120 cases evaluated in this study, 53 percent (n=63) were male and 47 percent (n=57) were female. The average age was 72 months (6 years) with a range from 18 months to 134 months. The age distribution of the study population, Table 1, was grouped according to the amblyopia risk factor categories found in the automated
screening guidelines by Donahue et al. Racial demographics are presented in Table 2.

The average time taken for a child to reach an initial appointment with an eye care professional after being identified in a CVSI screening exam was 85 days with the shortest follow-up being nine days and the longest 686 days. The treatment outcomes resulting from patient initial appointments to their eye care professional referrals stratified by age category are provided in Table 3. The most common outcome from referral was glasses alone (77 percent) followed by no intervention (17.5 percent).

After professional evaluation, it was discovered that 23 percent (N=27) of the 120 cases referred by SPOT screening were later diagnosed with amblyopia in their eye care professional examination. Of these 27 cases the majority, 55 percent (N=15), were diagnosed in children older than 6 years. The 27 cases diagnosed with amblyopia have been stratified according to age and race in Table 4.

Performance evaluation of the SPOT device on achieving an appropriate assessment of potential conditions when compared against final diagnoses made on eye care professional follow-up demonstrated good specificity for each of the amblyopia risk factors examined. Table 5 SPOT screening results showed comparable sensitivity in the detection of refractive amblyopia risk factors which included astigmatism (76 percent) and anisometropia (75 percent) causes. Detection of strabismus showed a much lower sensitivity coupled with a low PPV. The Positive Likelihood ratio for astigmatism (5.5), anisometropia (7.5), and strabismus (14.3) as well as the Negative Likelihood ratio at 0.28, 0.28, and 0.52 for each risk factor, respectively, were calculated.

The results of power vector comparison analysis between SPOT and PEFs are shown in Table 6. Comparison of the right eye M power vector between SPOT and PEF patient data was detected to show a mean difference in refractive error measurement (p<0.01). Left eye M power vector comparison between SPOT and PEF data also showed reasonable difference (p=0.05). For all other power vectors contrasted (J0 and J45) on either eye no statistically significant difference was detected.

**Discussion**

The results of this study demonstrate the importance of identifying techniques aiding the early detection of amblyopic risk factors in children that can lead to the loss of vision and a diminished quality of life. Out of the 27 cases presenting with some detectable degree of amblyopia confirmed through eye care professional follow-up in this study over half were found in children beyond the age of 6 years old. This combined with the observation that the majority of screening referrals were composed of children in the “Late Preschool/Kindergarten” age category, along with the fact that most treatment interventions occurred.

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**Table 1. SPOT screening population age distribution**

<table>
<thead>
<tr>
<th>Age categories: (months)</th>
<th>Toddlers (12-30)</th>
<th>Early preschool (31-48)</th>
<th>Late preschool/Kindergarten (49-72)</th>
<th>School-aged children (&gt;72)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL (n/%):</td>
<td>4 / (3%)</td>
<td>11 / (9%)</td>
<td>56 / (47%)</td>
<td>49 / (41%)</td>
</tr>
<tr>
<td>Male (n)</td>
<td>2</td>
<td>6</td>
<td>29</td>
<td>26</td>
</tr>
<tr>
<td>Female (n)</td>
<td>2</td>
<td>5</td>
<td>27</td>
<td>23</td>
</tr>
</tbody>
</table>

**Table 2. SPOT screening referral population racial demographics**

<table>
<thead>
<tr>
<th>Race</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>60 (50%)</td>
</tr>
<tr>
<td>American Indian</td>
<td>26 (22%)</td>
</tr>
<tr>
<td>Black/African American</td>
<td>3 (2.5%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>3 (2.5%)</td>
</tr>
<tr>
<td>Asian</td>
<td>1 (0.5%)</td>
</tr>
<tr>
<td>Other*</td>
<td>2 (1.5%)</td>
</tr>
<tr>
<td>Unknown+</td>
<td>25 (21%)</td>
</tr>
</tbody>
</table>

*One individual self-identified into multiple racial categories white/American Indian/Hispanic/Hawaiian/Pacific Islander and the remaining individual designated other without identifying.

+Patient race was not designated on Eye Care Professional Evaluation Form.

**Table 3. Treatment outcomes from SPOT screening referrals**

<table>
<thead>
<tr>
<th>Age categories: (Months)</th>
<th>Toddlers (12-30)</th>
<th>Early preschool (31-48)</th>
<th>Late preschool/Kindergarten (49-72)</th>
<th>School-aged children (&gt;72)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL (n/%):</td>
<td>4 / (3%)</td>
<td>11 / (9%)</td>
<td>56 / (47%)</td>
<td>49 / (41%)</td>
</tr>
<tr>
<td>Glasses (n)</td>
<td>2</td>
<td>9</td>
<td>42</td>
<td>39</td>
</tr>
<tr>
<td>Glasses and patching (n)</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Glasses and vision therapy (n)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Surgery (n)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Vision therapy (n)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Other (n)*</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>None (n)</td>
<td>2</td>
<td>2</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

*Two patients were scheduled for future follow-up at one and five months without mention of treatment plan or goals.
in this age group, further helps to show the impact that can be made through early identification permitting subsequent intervention. It is also noteworthy to observe that in this study 82 percent (n=99) of cases referred to eye care professionals were found to be in need of additional therapy as a result of examination findings.

Even though 23 percent of all children referred for amblyopic risk factors had detectable amblyopia discovered in their professional follow-up appointment, most were treated with glasses alone. This is an important observation, as typically only children with severe amblyopia are treated initially with more intensive measures, which explains why only a few children received any other treatment. Given that early stages of amblyopia can usually be remedied by correcting the underlying risk factor condition, most eye care professionals will do a trial treatment with glasses alone at the initial visit. Treatment is further augmented by close follow-up at two to three months after the glasses are provided. This strategy allows time to see if a condition may be corrected and can also help to confirm whether or not a more permanent visual deficit exists by increasing the visual acuity data available to support a diagnostic decision.

A recent guideline put out by the American Association for Pediatric Ophthalmology and Strabismus Vision Screening Committee emphasized how the screening effort for amblyopic risk factors must be looked at as a continuous process during a child’s visual development. Early screening allows time to see if a condition may be corrected and can also help to confirm whether or not a more permanent visual deficit exists by increasing the visual acuity data available to support a diagnostic decision.

The number of photoscreener options presently available is extensive and has been well described in a prior review. Quality assessment of photoscreeners in both clinical and field settings has been evaluated by many studies which have shown good agreement in refractive error estimation when compared to the gold standard of cycloplegic.

### Table 4. Amblyopia diagnosis demographics by age and race

<table>
<thead>
<tr>
<th>Age categories: (Months)</th>
<th>Toddlers (12-30)</th>
<th>Early preschool (31-48)</th>
<th>Late preschool/kindergarten (49-72)</th>
<th>School-aged children (&gt;72)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL (n/%):</td>
<td>1 (4%)</td>
<td>1 (4%)</td>
<td>10 (37%)</td>
<td>15 (55%)</td>
</tr>
<tr>
<td>White (n):</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>American Indian (n):</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>N/A*</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

*Patient race not declared on the Eye Care Professional Evaluation Form.

### Table 5. SPOT screening performance on detection of select amblyopia risk factors compared to eye care professional evaluation forms

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Sensitivity*</th>
<th>Specificity*</th>
<th>PPV*</th>
<th>NPV*</th>
<th>DOR*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astigmatism</td>
<td>76%</td>
<td>86%</td>
<td>96%</td>
<td>44%</td>
<td>19.5</td>
</tr>
<tr>
<td>Strabismus</td>
<td>50%</td>
<td>96%</td>
<td>43%</td>
<td>97%</td>
<td>27.5</td>
</tr>
<tr>
<td>Anisometropia</td>
<td>75%</td>
<td>90%</td>
<td>60%</td>
<td>94%</td>
<td>27</td>
</tr>
</tbody>
</table>

DOR = diagnostic odds ratio; PPV = positive predictive value; NPV = negative predictive value. *Values calculated from a positive-screened cohort.

### Table 6. Power vector comparison of refractive error measurements**

<table>
<thead>
<tr>
<th>Eye Measurement</th>
<th>Mean</th>
<th>SD</th>
<th>CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M SPOT</td>
<td>0.25 D</td>
<td>1.34 D</td>
<td>0.26</td>
<td>0.006</td>
</tr>
<tr>
<td>M PEF</td>
<td>0.90 D</td>
<td>2.02 D</td>
<td>0.39</td>
<td></td>
</tr>
<tr>
<td>J0 SPOT</td>
<td>0.63 D</td>
<td>0.66 D</td>
<td>0.13</td>
<td>0.401</td>
</tr>
<tr>
<td>J0 PEF</td>
<td>0.56 D</td>
<td>0.60 D</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>J45 SPOT</td>
<td>0.10 D</td>
<td>0.37 D</td>
<td>0.07</td>
<td>0.477</td>
</tr>
<tr>
<td>J45 PEF</td>
<td>0.07 D</td>
<td>0.27 D</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>OS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M SPOT</td>
<td>0.31 D</td>
<td>1.56 D</td>
<td>0.30</td>
<td>0.05</td>
</tr>
<tr>
<td>M PEF</td>
<td>0.81 D</td>
<td>2.11 D</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>J0 SPOT</td>
<td>0.51 D</td>
<td>0.70 D</td>
<td>0.13</td>
<td>0.786</td>
</tr>
<tr>
<td>J0 PEF</td>
<td>0.49 D</td>
<td>0.64 D</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>J45 SPOT</td>
<td>-0.02 D</td>
<td>0.33 D</td>
<td>0.06</td>
<td>0.802</td>
</tr>
<tr>
<td>J45 PEF</td>
<td>-0.03 D</td>
<td>0.26 D</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

Cl = 95 percent confidence interval; J0 = Jackson cross-cylinder lens equivalent at 0 degrees; J45 = Jackson cross-cylinder lens equivalent at 45 degrees; M = spherical equivalent; OD = right eye; OS = left eye; PEF = Eye Care Professional Evaluation Form refractive error (performed using cycloplegic technique); SD = standard deviation.

**Power vector refractive error statistics are generated from pool of 108 patients since 12 cases had no refractive error measurements reported on Eye Care Professional Evaluation Forms to compare with SPOT results.
refractive measurements in professional offices.\textsuperscript{2,5,20,21}
Overall, the results of this study on examining performance measures for the SPOT device’s amblyopia risk factor detection capabilities and refractive error estimation are similar to findings by others examining it and additional photoscreener models in community and clinic based screening efforts.\textsuperscript{2,5,20,21}

Important limitations of this study to recognize are the retrospective nature and that an initially positive-screened cohort was evaluated. Given this, it is important to note that screening test performance measures did not include normal-screened children as they were not referred for professional follow-up. Therefore, the false negative and true negative quantities depicted in the data represent children who were referred initially with at least one possible risk factor and were instead found to have either additional risk factors or a completely different risk factor upon completion of their professional follow-up evaluation.

Conclusion
This quality assessment of the screening efforts by NPEF in the CVSI project using the SPOT device has identified highly favorable preliminary results. This has been demonstrated both in terms of the quality in SPOT device performance on the identification of amblyopic risk factors, capacity for measuring refractive errors, and through screening follow-up benefit that is reflected in the high percentage of children who received treatment on referral to professional eye care services. Vision screening performed using the SPOT device represents a valuable modality that is easily employable and can provide tremendous benefit to children of the state of South Dakota. It provides a way to help further ensure the healthy development of vision for children by allowing for timely and effective professional referral when needed.

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About the Authors:
Jed H. Assam, MD, MS, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota.
Tanner Ferguson, BS, MS IV, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota.
Nicole West, BS, MS IV, University of South Dakota Sanford School of Medicine, Sioux Falls, South Dakota.
Terrence S. Spencer, MD, Black Hills Regional Eye Institute, Rapid City, South Dakota.
The day began in the usual busy fashion. As the faculty physician emerged from the exam room after seeing the first patient of the day, he encountered a medical student who’d come to join him. On many days, the physician had medical students or a resident rotating with him, but he felt a twinge of annoyance because the student had arrived after 8:00 AM and thus missed seeing the first patient entirely. Also, the physician had not expected a learner on this day and was initially confused as to whether the young man was a student or resident. The dark suit he wore and his stethoscope suggested the latter. But clarification was offered and the physician eventually determined that he’d been joined by a first year student who was doing a half day clinical correlation session. Some exasperation must have been evident to the student.

I can come back some other day since you weren’t expecting me.

The attending physician reassured him that he was welcome to stay.

Over the next hour, the student seemed attentive, but was frequently checking his cell phone. This served as a further annoyance to the physician, as all too often students and residents these days seem to allow cell phone communications to intrude upon clinical time. The physician considered a cautionary comment, but opted instead to focus on the patients at hand. The student, for his part, seemed engaged and posed several relevant questions about the patients they encountered, but continued to frequently consult his phone. Occasionally, he seemed to send a brief text message.

At some point, as the physician was focusing on computer data for a follow-up patient, the student looked up from his phone. My sister is in hospice. Suddenly the student’s searching for text messages made sense. I may get called away. The physician tried to respond sympathetically. I’m sorry to hear that. More clarification was cautiously sought. It’s ovarian carcinoma. She’s BRCA positive. After completing a follow-up exam, another gentle query was made. She’s 33 years old. And still later, a bit more was disclosed. We have a younger brother. This is very hard for my Mom.

The medical student opened his eyes and looked at the clock. Okay, 3:30AM. If I fall asleep now I can still get 3 hours of sleep, he told himself. That’s better than nothing. His mind needed to be sharp that morning. He was scheduled to have one of his first ever clinical experiences as an MS1 with a faculty physician. Stop thinking. SLEEP. Despite his brain’s clamor for rest, his ears betrayed him and were on full alert; every little creak was amplified and heard with vivid clarity. He waited for the phone next to the pillow to shatter the silence and fill it with his mother’s voice. For the past year, he’d been dreading the news that his sister’s death was near and that he needed to go to the hospice house immediately to say final goodbyes.

But the call never came that night. After perhaps an hour of desperately needed sleep, he awoke to the blaring alarm. He hit snooze, which was atypical. Nine minutes later, he dragged himself into the shower, being sure to keep the phone nearby so as not to miss any call or text message. Then he quickly gathered his things and began the drive to physician’s office. As he glanced at the clock, he realized to his horror that he was going to be late.

Oh no. How did this happen? Oh no. Why, oh why, did I hit snooze? This had all the hallmarks of an uncaring, lazy first year student: being late, looking disheveled from sleep deprivation, and worst of all, being distracted by his phone. What a first impression. Fantastic.

When the student arrived at the clinic, the physician seemed surprised. I don’t think I have a medical student today. You’re on my schedule for tomorrow. Although the student was certain he had come on the correct date, he knew that asserting this would only make things worse. In an effort to recoup some semblance of professionalism, the student swallowed his pride, admitted the mistake may have been his own, and offered to reschedule for another day.
you can stay. Despite the emotional turmoil, the student was relieved. The coffee kicked in and he was feeling more clearheaded. This day in the clinic was exactly what he needed to keep his mind busy while waiting for the news. The alternative, endless ruminating, was unappealing.

Despite the setbacks early in the day, the physician did not appear to be harboring any resentment. He seemed eager to teach and the student was eager to learn. He was able to successfully distract himself, but still found himself compulsively checking his phone for any news from his mother. Fearing further damage to his reputation, the student tried to be inconspicuous with his glances. He thought he’d been successful in not drawing attention to his phone. However, after he’d sent a reassuring text to his mother, the student looked up and saw the physician looking directly at the phone as he put it back in his pocket. Although the physician didn’t display annoyance, this transgression crossed the line. The student had always made it a goal to keep his personal life and professional life separate as best he could, but he knew at that moment that an explanation was needed. I hope he doesn’t think I’m making this up just to garner sympathy.

We don’t know what we don’t know about each other. This is true with respect to patients, colleagues and students. Closely listening to one another and “hearing the story” is vital to providing effective healthcare. Of course, much has been written and discussed about the techniques and subtleties of obtaining an accurate patient history. And the current national focus on quality and safety in medicine has highlighted the importance of accurate communication between members of a healthcare team. But less emphasis has been placed on effective interpersonal communication between medical school faculty and learners. For years there have been accounts, often from the so-called “hidden curriculum” of medical schools, about pimping and harassment of students. Clearly educators have the ability to either nurture and encourage or to render significant harm, based on how they respond to students. In any relationship with a power differential between parties, distracted listening or “jumping to conclusions” can enhance the likelihood of misunderstanding.

Often, it is hard to determine when we should give someone the benefit of the doubt. However, many of us fail at the very first step; we don’t even consider such leeway to be an option. We make snap judgements based on a single behavior we observe without even considering the potential circumstances that led to that behavior. We blame others’ mistakes on inherent character flaws. But when we are considering our own behaviors, we take into account any extenuating circumstances and tend to attribute our shortcomings to the unique conditions that led to that moment. We certainly don’t think there is something fundamentally wrong with our own character because of one single questionable action. For example, when one observes a co-worker using a cell phone, is the first thought something to the effect of: “Ugh. Slacker. Doesn’t (s)he have work to do?” We all have had thoughts like this. In contrast, if the roles are reversed, we readily have a valid excuse for our behavior: “Well of course I had to look at my phone! I need to know when to pick the kids up from practice.” As the late George Carlin succinctly observed, “All drivers that drive faster than me are maniacs, and all the drivers slower than me are morons!” This is a fundamental problem we all face. By recognizing our own internal biases, we can help to overcome them.

In the clinical, as well as the educational, realm, context can be crucial. Interpersonal communications cannot always be predictably scripted and relevant cues can be missed. Despite good intentions, missteps can occur causing our perspective of an individual to become distorted. There is no acclaimed formula to ensure we always “get things right” in the vast realm of human interaction. Proper attention and a persistent will to clarify can be helpful. Sometimes we are aided by a random observation or an unexpected disclosure. And then there are occasions when good fortune and serendipity are needed to help us find our way.
The publication of the 2013 American College of Cardiology (ACC) and American Heart Association (AHA) Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults commenced a new era of how to approach dyslipidemia management. Suddenly, low-density lipoprotein cholesterol (LDL-C) treatment goals dissolved and atherosclerotic cardiovascular disease (ASCVD) risk reduction directed dyslipidemia therapy. This has initiated many debates and lead to the publication of other dyslipidemia treatment guidelines, such as the 2015 National Lipid Association Recommendations for Patient-Centered Management of Dyslipidemia and the 2017 American Association of Clinical Endocrinologists (AACE) and American College of Endocrinology Guidelines for Management of Dyslipidemia and Prevention of Cardiovascular Diseases. These three guidelines will be briefly reviewed.

The 2013 ACC/AHA Guideline eliminates low-density lipoprotein cholesterol and total cholesterol goals. Instead, a calculated 10-year ASCVD risk score determines if a patient is to receive low, moderate, or high intensity statin therapy (Table 1). These guidelines find the ASCVD risk reduction benefit to exceed the adverse effect potential in the following patient groups: (1) patients with clinical ASCVD, (2) patients with LDL-C ≥190 mg/dL, (3) patients 40-75 years of age with diabetes and LDL-C 70-189 mg/dL, (4) patients 40-75 years of age without clinical ASCVD or diabetes and LDL-C 70-189 mg/dL and an estimated 10-year ASCVD risk of ≥7.5%. Patients with clinical ASCVD less than 75 years of age should receive a high intensity statin, regardless of 10-year ASCVD risk. Other indications for a high intensity statin include patients with an LDL-C ≥190 mg/dl or patients with diabetes who have a 10-year ASCVD risk ≥7.5%. Patients with clinical ASCVD greater than 75 years of age or patients who do not tolerate high intensity statins should receive a moderate intensity statin. Although specific LDL-C goals are not delineated, each statin intensity has an associated LDL-C reduction (Table 1), which can help guide therapy.

The 2015 NLA Guideline approaches dyslipidemia...
### Figure 2.

**ASCVD Risk Assessment and Treatment Goals**
*(2015 National Lipid Association Recommendations for Patient-Centered Management of Dyslipidemia)*

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Criteria</th>
<th>Treatment Goal</th>
<th>Consider Drug Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Non-HDL-C LDL-C</td>
<td>Non-HDL-C LDL-C</td>
</tr>
<tr>
<td>Low</td>
<td>- 0-1 major ASCVD risk factors</td>
<td>&lt;130</td>
<td>&gt;190</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;100</td>
<td>&gt;160</td>
</tr>
<tr>
<td>Moderate</td>
<td>- 2 major ASCVD risk factors</td>
<td>&lt;130</td>
<td>&gt;160</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;100</td>
<td>&gt;130</td>
</tr>
</tbody>
</table>
| High          | - ≥3 major ASCVD risk factors  
                      - Diabetes mellitus  
                      - 0-1 other major ACVD risk factors and no evidence of end-organ damage  
                      - CKD stage 3B or 4  
                      - LDL-C ≥190 mg/dL | <130 | >130 |
|               |          | <100 | >100 |
| Very High     | - ASCVD  
                      - Diabetes mellitus  
                      - ≥2 other major ASCVD risk factors or evidence of end-organ damage | <100 | >100 |
|               |          | <70 | >70 |

*Abbreviations: CKD: chronic kidney disease*

### Figure 3.

**Atherosclerotic Cardiovascular Disease Risk Categories and Treatment Goals**
*(2017 American Association of Clinical Endocrinologists and American College of Endocrinology Guidelines for Management of Dyslipidemia and Prevention of Cardiovascular Diseases)*

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Risk factors/10-year ASCVD risk</th>
<th>Treatment Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LDL-C</td>
</tr>
</tbody>
</table>
| Extreme Risk  | - Progressive ASCVD including unstable angina in patients after achieving an LDL-C <70 mg/dL  
                      - Established clinical cardiovascular disease in patients with DM, CDK 3 or 4, or HeFH  
                      - History of premature ASCVD (<55 years male, <65 years female) | <55 | <80 |
| Very High Risk| - Established or recent hospitalization for ACS, coronary, carotid, or peripheral vascular disease, 10-year risk >20%  
                      - Diabetes or CKD 3 or 4 with ≥1 risk factor(s)  
                      - HeFH | <70 | <100 |
| High Risk     | - ≥2 risk factors and 10-year risk 10-20%  
                      - DM or CKD 3 or 4 with no other risk factors | <100 | <130 |
| Moderate Risk | - ≤2 risk factors and 10-year risk <10% | <100 | <130 |
| Low Risk      | - 0 risk factors | <130 | <160 |

*Abbreviations: ACS: acute coronary syndrome; DM: diabetes mellitus; CDK: chronic kidney disease; HeFH: heterozygous familial hypercholesterolemia*
management by refocusing on LDL-C and non-HDL-C treatment goals. This guideline was developed by an expert panel with the premise that reducing cholesterol will lower ASCVD risk and that benefit is derived from multiple modalities. Although the expert panel acknowledges that LDL-C and non-HDL-C goals have not been assessed under randomized controlled trials, ASCVD risk assessment with subsequent LDL-C and non-HDL-C treatment goals are endorsed (Table 2). Major risk factors for ASCVD include: age (males ≥45 years, females ≥55 years), family history of early coronary heart disease, current cigarette smoking, high blood pressure (≥140/≥90 mmHg or on antihypertensive agents), and low HDL (male <40 mg/dL, female <50 mg/dL). Statins remain the mainstay of pharmacologic treatment with lifestyle modifications. Specific treatment goals may facilitate effective ASCVD risk reduction progress assessment and patient-provider communication, which may further encourage patient medication adherence.

The 2017 AACE Guideline also focuses on ASCVD risk reduction by treating to LDL-C and non-high density lipoprotein cholesterol goals (HDLC), affirming that lower LDL-C and non-HDL-C goals lead to greater ASCVD risk reduction. For this reason, specific LDL-C levels, with goals ranging from <55 to <130 mg/dL based on the patient’s risk category, are targeted. There are five risk categories: extreme, very high, high, moderate, and low risk. Factors taken into consideration can be found in Table 3. Major independent risk factors include high LDL-C, polycystic ovary syndrome, smoking, hypertension, low HDL-C, family history of coronary artery disease, and coronary artery calcification. The unique extreme risk category recommends very aggressive LDL-C lowering (<55 mg/dL), which is the first time a LDL-C goal this low has been sanctioned. The 2017 AACE Guideline hinges from the 2014 IMPROVE-IT trial, which showed that tight lipid control benefits very high and extreme risk patients, and the FOURIER trial, which showed decreased major cardiovascular events when lowering LDL-C to an average of <30 mg/dL.

As dyslipidemia research continues, more data will become available to validate or revise dyslipidemia management approaches. Ideally, the correlation of cholesterol levels and cardiovascular events will be identified, which will guide dyslipidemia management. At this time, the ACC focuses on ASCVD risk reduction with appropriate statin use versus the NLA and AACE focus on assuming cholesterol treatment goals to reduce ASCVD risk. As guidelines are applied to patient care, it may be most appropriate to employ a hybrid of guidelines by either increasing or decreasing the initial statin intensity to meet specific cholesterol goals. Although ideal dyslipidemia management practices are not known, the current guidelines provide a starting point for assessing and managing patients with ASCVD risk.

REFERENCES

About the Authors:
Emily Van Klompenburg, PharmD, Assistant Professor, Dept. of Pharmacy Practice College of Pharmacy and Allied Health Professions, South Dakota State University Andrea Burr, PharmD Candidate 2018 Shelby Young, PharmD Candidate 2018
While running with a scientist friend who had recently suffered a small heart attack, we talked about cardiac rehabilitation and safe running to help his recovery. He was happy to be back running, and as I was recovering from cancer surgery, I was also happy to be back running. If not over-done, we know that those with and without heart disease do better by regularly exercising. I could feel the run was rebuilding my strength and savored the social time running with a friend. When we finished, energized and happy, a short cool-down walk brought us to his home.

There, his wife prepared a light morning breakfast of two eggs nicely spiced with salt and pepper, a small patty of pork sausage, sliced fried bell-peppers, pieces of fresh melon on the side, and coffee. It was delicious and just the right amount. Twenty years ago, an eggs and sausage meal was thought to be a big no-no. Now, new science has discovered it is NOT the fat and protein in a diet that causes atherosclerosis, but rather it is the excessive calories. More treacherous than type of food is quantity of food. If this doesn’t shake your world enough, we have also learned that processed carbohydrates are bad, while a balanced diet of proteins, fats, and small amounts of non-processed carbohydrates are good. For example, large helpings of carbohydrates like potatoes, pasta, pancakes, bread, or donuts can be harmful. Smaller amounts of foods like eggs and sausage are safe. That morning the calorie count for each of us was about 300 and we both felt great.

Every day there seems another study that advises the opposite of what we used to think: eat less salt, now salt to taste unless the heart is weak; don’t eat butter, now butter is caloric but safe; don’t exercise too much, now do it every day; don’t drink alcohol, now a daily glass of wine is good, and, finally, don’t eat fatty meals, now eat fewer calories and avoid processed carbohydrates. We have always known about the health benefits of friendship, and no one has refuted that.

In summary, researchers have made headway in understanding what is good for us. May we embrace the science that supports eating fewer calories, less processed carbohydrates, and more fruits and vegetables. If we can also find time for a daily 30-minute stretch of exercise and some quality time with friends, then we have the perfect formula for good health.
South Dakota Board of Medical and Osteopathic Examiners
2018 Legislation Update

The South Dakota Board of Medical and Osteopathic Examiners (SDBMOE) submits a column to South Dakota Medicine to inform physicians and other licensees about various topics of interest that come to the Board. Here is an update of the new 2018 laws that are of interest or directly affect SDBMOE licensees.

Senate Bill 71 (SB 71) was sponsored by the South Dakota Medical Association and is effective on July 1, 2018. This new law makes two changes to the South Dakota Medical Practice Act:
1. Requires physicians to notify the Board, within 30 days, of any acts, including but not limited to:
   a. Any changes in contact information, unprofessional conduct, malpractice or privilege to practice issues, hospital disciplinary actions, alcohol or substance abuse issues, and law enforcement issues.
2. Medical licenses change from an annual renewal to a two (2) year renewal in the odd numbered years. This law will be in effect after July 1, 2018. The initial, reinstatement, and biennial renewal license fees for physicians were all increased to $400.00 as required.

House Bill 1019 (HB 1019) revised provisions regarding background checks for physicians and was passed by the South Dakota Legislature with an emergency provision, and was made effective upon Governor Daugaard’s February 5, 2018 signature. The bill requires an applicant for expedited licensure (through the Interstate Medical License Compact) to submit to a criminal background investigation.

House Bill 1020 (HB 1020) revised provisions and regulations regarding medical assistants after 2017 legislation ended the joint regulation of the Board of Medical and Osteopathic Examiners and the Board of Nursing. This legislation removed references to the Board of Nursing and any mention of joint regulation in the medical assistant practice act, and is effective after July 1, 2018.

House Bill 1079 (HB 1079) was sponsored by the South Dakota Physical Therapy Association to allow physical therapists with advanced training to perform dry needling. Physical therapist assistants are not included in this law and are not permitted to perform dry needling. The bill will go into effect after July 1, 2018; however, dry needling cannot take place until rules regarding dry needling have been established and passed by the SDBMOE. Every effort is being made to have the rules in place by July 1, and the SDBMOE will be informing all physical therapists of the process before the performance of dry needling can begin.
Hypertension: The Challenges of Appropriate Diagnosis and Treatment Continue

By Stephan Schroeder, MD, CMD, CMQ
Medical Director, South Dakota Foundation for Medical Care

February is American Heart Month and offers an opportunity to focus on a significant factor in cardiac health: hypertension. The diagnosis and treatment of this condition should be an emphasis of patient care no matter the location or the specialty of the provider. Making the patient aware of hypertension and providing accurate diagnosis, treatment or referral, if needed, should be a priority for all clinicians. It has importance in maintaining population health and should not be ignored or taken for granted. The costly consequences in life years and dollars from untreated blood pressure (BP) are staggering. The value of appropriate management is enormous in helping decrease the potential bad outcomes of cerebrovascular disease.

In late 2017 a set of guidelines for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults was released by the American College of Cardiology and the American Heart Association Task Force on Clinical Practice Guidelines. It is 481 pages in length and contains 106 graded recommendations. These Guidelines represent a comprehensive resource that has been the subject of many journal editorials and viewpoints. There are some significant changes from previous recommendations and values previously considered normal will now be considered for treatment. See guidelines below.

<table>
<thead>
<tr>
<th>Blood Pressure Range</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120/80</td>
</tr>
<tr>
<td>Elevated</td>
<td>120-129/80</td>
</tr>
<tr>
<td>Stage 1</td>
<td>130-139/80-89</td>
</tr>
<tr>
<td>Stage 2</td>
<td>&gt;140/90</td>
</tr>
</tbody>
</table>

Based on the new BP guidelines, estimated prevalence of hypertension in the US will raise to nearly 46 percent of the population. In addition, at least two to three BP measurements with proper technique are recommended to confirm the diagnosis. Values collected outside of the provider office, such as at home or with a wearable monitor, are recommended to confirm the diagnosis and for the titration of medication dosing if needed.

In the area of initiation of therapy, there is an emphasis on nonpharmalogic interventions for those with elevated pressures. Initiation of medication therapy depends on both the pressure level and cardiovascular disease risk. Long-term management includes recommendations on types of medication. In Stage 2 patients with an average BP of more than 20/10mm Hg above the target, treatment should begin with two first-line agents. Systolic BP has evolved as a more important measurable factor.

A few editorials have commented that translating the updated guidelines to clinical practice has a number of challenging elements. Patient education, practice organization and clinical endpoint performance measurement will all likely be affected. Electronic health record (EHR) interoperability and team based care, including community services and telemedicine, are also needed to help transform BP management. The need for more frequent clinical encounters may affect compliance and follow-up care as well as the affordability and cost of this care. Potential harms from polypharmacy treatment reinforce the need for a shared decision making process with patients and family concerning risks and benefits, especially in elderly patients.

Changing guidelines and recommendations are often a source for differing opinions and challenges, i.e., lipid targets, mammogram age categories, PSAs, yearly wellness exams. The true challenge should not be the adopting of newer more rigorous hypertension guidelines, but rather attempting to change cardiovascular risk factors. The focus should lie with healthy lifestyle changes. The benefits of weight loss, salt avoidance, limited alcohol use, exercise and diets, such as the DASH diet, have and will continue to be modifiable factors that are crucial to augment pharmacologic treatment. This may help to slow or alter the development of hypertension in the first place. Then, when needed, the medications can reduce the risk using evidence-based recommendations.

One of the Great Plains Quality Innovation Network (QIN) projects has the goal of improved cardiovascular care and reduced cardiac healthcare disparities, including BP control. The Great Plains QIN can provide technical assistance as well as learning events to assist clinics and home health agencies in quality reporting and improved outcomes. Please contact me (Stephan.Schroeder@area-a.hcqis.org) or Holly Arends, CHSP, CMQP (Holly.Arends@area-a.hcqis.org, 605.660.5436) for more information.
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“For Your Benefit” is the SDSMA’s monthly update on programs and services available to physicians through their affiliation with the SDSMA.

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**Legal Brief Highlight: Ending the Physician-Patient Relationship**

Once a patient-physician relationship is begun, a physician generally is under both an ethical and legal obligation to provide services as long as the patient needs them. There may be times, however, when a physician is no longer able to provide care. It may be that the patient is noncompliant, unreasonably demanding, threatening to you and/or your staff or otherwise contributing to a breakdown in the patient-physician relationship. Or, it may be necessary to end the relationship simply due to relocation, retirement or unanticipated termination by a managed care plan and/or employer.

Challenges can arise when the physician desires to terminate the relationship, yet the patient continues to present for treatment. Further, if the relationship is terminated without proper notice, or in a way that harms the patient, civil liability could result. The requirement of assistance and an opportunity to make alternative arrangements applies regardless of the reason the physician desires to terminate the relationship, including but not limited to failure to pay, failure to follow the physician’s advice, or general bad behavior on the part of the patient.

A physician must provide notice of his or her intent to terminate the relationship so that the patient has sufficient time to make alternative arrangements. Thirty days’ notice of termination is recommended, and it is also appropriate to provide a referral or other resources the patient can use to locate a new physician. The physician must continue to treat the patient while the patient seeks a replacement caregiver.

A provider remains responsible for record maintenance regardless of the termination of the physician-patient relationship. In addition, the patient is entitled to a copy of his or her medical records upon request.

More information is available in the SDSMA legal brief, *Termination of the Physician-Patient Relationship* at www.sdma.org. Through the SDSMA Center for Physician Resources, the SDSMA has developed more than 50 legal briefs that are available to members. In addition, the Center develops and delivers programs for members in the areas of practice management, leadership and health and wellness.

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**Membership Mixer is Networking Opportunity**

Members are invited to the SDSMA’s Membership Mixer from 6-7 pm Friday, June 1 at the Hilton Garden Inn, Downtown Sioux Falls during the 2018 SDSMA Annual Leadership Conference.

Enjoy a unique and fun opportunity to meet SDSMA leaders and network with your peers. Meet other physicians in the state to expand your professional network and share ideas. The event is sure to be an all-around great time! Spouses are welcome to attend. Drinks and hors d’oeuvres will be served.

The mixer is free of charge. Tickets are required for the Awards Banquet & Scholarship Recognition following the mixer. To buy banquet tickets, please visit www.sdsm.org or call 605.336.1965.
Registration Deadline Approaching – 2018 SDSMA Annual Leadership Conference

The 2018 SDSMA Annual Leadership Conference is in Sioux Falls at the Hilton Garden Inn Downtown on June 1. The May 18 deadline to register is quickly approaching.

With presentations, discussions, networking opportunities and social events, the Annual Leadership Conference is a great time to share ideas and learn from fellow members.

Check out the schedule and events! The Annual Leadership Conference is a benefit of your membership. For the latest details about exciting events taking place during the 2018 SDSMA Annual Leadership Conference, visit www.sdsm.org. Buy your tickets for the banquet and SDSMA PAC lunch online.

Those who need a hotel room may call the Hilton Garden Inn at 605.444.4704 and ask for the South Dakota State Medical Association block.

Join Us for Awards Banquet & Scholarship Recognition

Enjoy a fun-filled evening of celebration Friday, June 1 at the 2018 SDSMA Annual Leadership Conference at the Hilton Garden Inn, Downtown Sioux Falls.

Start the evening with the Membership Mixer at 6 p.m., and continue the celebration at the Awards Banquet and Scholarship Recognition, where Christopher T. Dietrich, MD, will be sworn in as SDSMA president, awards will be bestowed upon fellow colleagues, outgoing and incoming officers will be celebrated and welcomed, and medical student scholarship recipients will be recognized.

The mixer is free of charge; banquet tickets must be purchased in advance. To buy tickets and register for other annual meeting activities, visit sdsm.org. Please purchase tickets and register by May 18.

Updates from the South Dakota Department of Social Services

New Claim Denials – providers are reminded to ensure that enrollment and billing staff collaborate to capture the taxonomy code on the enrollment record as that is the one that will be used on claims. Unless South Dakota Medicaid requires differentiating taxonomy codes for different services, only one taxonomy code for an individual practitioner should be captured. Providers will see claims denials if taxonomy codes are not populated or fail to match the enrollment record.

Policy Information for Other Insurance Carriers – Effective April 1, 2018 through September 30, 2018, policy numbers for recipients with commercial insurance and Medicare will not be displayed through electronic eligibility inquiries, including the portal. If in need of this information providers may call the Telephone Service Unit: (800) 452-7692.

Secure Email – On May 1, 2018, South Dakota Medicaid will utilize secure email as the default for all outgoing emails. For providers and stakeholders that have not utilized secure email in the past, they will not be required to create a login, but new users may need to verify their email address. This will have no effect for providers and stakeholders that have previously communicated about Protected Health Information through email.

Source: South Dakota Department of Social Services

Get Ready for New Medicare Cards

Between April, 2018 and April, 2019, the Centers for Medicare & Medicaid Services (CMS) will mail new Medicare cards to all people on Medicare. The new cards will have a new unique Medicare Number instead of a Social Security Number. Medicare will automatically mail the new cards to the beneficiary address on file with the Social Security Administration.

CMS will mail the new cards in waves. Starting in April 2018, people with Medicare will be able to check the status of card mailings in their area on Medicare.gov. The first wave of cards will be mailed between April and June to people with Medicare in the following 11 states and territories: Alaska, American Samoa, California, Delaware, DC, Guam, Hawaii, Maryland, Northern Mariana Islands, Oregon, Pennsylvania, Virginia, and West Virginia.

After receiving a new card, people with Medicare are advised to take 3 steps to make it harder for someone to steal their information and identity: 1) destroy their old Medicare card; 2) Use their new card right away; and 3) they should beware of people contacting them about their new Medicare card and asking to verify information.

Source: Centers for Medicare & Medicaid Services
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**DECREASE**
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