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President’s Message

Melissa Oden, DHEd, LMSW-IPR, MPH, CHES

I have a confession to make: I am a HUGE fan of Broadway musicals. I love everything about them. But if you were to pin me down about exactly what it is that I love so much about them, it would have to be that I do not think there is a better way to tell a story through music. Stories help us make sense of the world around us, and when a musical score is added to the story, it just becomes sheer magic.

My all-time favorite composer is the musical genius Stephen Sondheim. He is, in fact, considered the greatest living composer of Broadway musicals. I was recently introduced, however, to a Broadway musical soundtrack by a playwright who just might have what it takes to overthrow Sondheim’s kingly status in the Broadway world. It is the hottest new musical on Broadway, “Hamilton: An American Musical”, composed by Lin-Manuel Miranda.

“Hamilton” is the musical story of Alexander Hamilton, one of the Founding Fathers of America. Miranda was inspired to create “Hamilton” after reading the Hamilton’s biography by author Ron Chernow. In a 2015 interview, Miranda said that he was impressed by the way the book read like a “Dickens novel”, and he began a Google search to see if a musical had previously been made about Hamilton’s life. All he could find was a stage play produced in New York around the story of Hamilton, “Dickens novel”, and he began a Google search to see if a musical had previously been made about Hamilton’s life. All he could find was a stage play produced in 1918. Upon this discovery, Miranda began working on an innovative project that would eventually lead to the creation of a hip-hop-inspired musical starring all Black and Hispanic actors. In early 2016, “Hamilton existed), and making a decision to do something about filling the gap, as it was creating an 11-time Tony award-winning musical. I submit to you that we are all public health playwrights in our respective environments simply trying to fill the gaps that face us every single day, and every once in awhile, we find a solution that is so imaginative (did I mention that “Hamilton” is the first Hip Hop musical on Broadway?) that it shifts the culture.

Culture shifting events don’t just happen on Broadway. I believe that as public health professionals, we are involved in innovative, culture-shifting activities on a daily basis whether we realize it or not. In fact, I would argue that the work that we do is very similar to the process Lin-Manuel Miranda went through in creating “Hamilton”. The good news is that process is not reserved only for great playwrights such as Sondheim and Miranda. It begins with a simple idea, usually sparked by surprise by a routine activity (reading a biography about one of the rather obscure Founding Fathers, perhaps?), doing some research and discovering a gap (only a 1918 play about Hamilton existed), and making a decision to do something about filling the gap, as it was creating an 11-time Tony award-winning musical. I submit to you that we are all public health playwrights in our respective environments simply trying to fill the gaps that face us every single day, and every once in awhile, we find a solution that is so imaginative (did I mention that “Hamilton” is the first Hip Hop musical on Broadway?) that it shifts the culture.

Culture phenomenons do not happen overnight. Miranda spent 6 years developing “Hamilton” before it debuted off Broadway. After a successful run off Broadway, the show opened on Broadway in August of 2015 and immediately became the hottest ticket in the Broadway community. From what I have read, the show is sold out until mid-2017. As if that were not inspiring enough, there is a bit more to this incredible story. Miranda was able to partner with the New York City School System and a couple of large foundations to create an entire educational curriculum for high school students in New York around the story of Hamilton, ending with a performance of the show for each student for only $10 per student. The result has been a school system-wide discussion of and increased engagement in American History and government. It was announced in the summer of 2016 that Miranda has also partnered with the school districts where “Hamilton on Tour” will be performing to offer the same curriculum and $10 tickets to students just like those
students in the New York schools. This endeavor reaches beyond the stage and the history book as Miranda’s story engages youth of multiple race/ethnicities through a favorite vehicle, music. I believe it is safe to say that Miranda is changing lives one student at a time and one performance at a time.

I know that there are issues that we have been working on in public health for years and years, and it seems like we will never make headway or find a solution – much longer than the 7 years that Miranda has been living with and developing the characters for his musical. In fact, you say, how can you even compare a Broadway musical to what we have to deal with in public health every day? My answer to you is simple. The universal principles of social influence and change are the same, whether it is a Broadway musical or a public health issue. There are two influencing factors in whether or not we are making progress with whatever it is we are working on, and those factors are our actions and our level of perseverance. Nothing happens until we take action, and nothing will change if we do not persevere through the obstacles that inevitably attempt to block us. If you think that Miranda had no challenges in getting from his idea for a musical about Alexander Hamilton to the Broadway stage on opening night, then you are sorely mistaken. I don’t know his specific story, but I recall the stories of others who have gone through the same process of getting an idea from their brains to the stage (case in point: Johnathan Larson of “RENT” fame). The two characteristics these folks seem to have in common are the courage to act and the ability to persevere through some pretty tough times. The other thing we should remember is that in the work we do we have to understand that we may never see the fruits of our efforts. However, that cannot stop us from doing the work that needs to be done. In fact, that work becomes our legacy even if we never see the results of our efforts.

So, I leave you with the two questions that Lin-Manuel Miranda says that he asks himself: “What is not in the world that needs to be in the world? What is the thing that only I can contribute?” I would urge you to keep these two questions in the back of your mind as you go about your work every day, and know that you are here in this place at this time for a reason. The public health world (and the world at large) needs what only you have to offer. I believe that you are in the right place at the right time to fulfill your purpose in this field, reach beyond your stage and find the perfect vehicle to best deliver to the greatest numbers. TPHA is here to support you in your endeavors through many avenues including our journal, annual meetings, website and the list goes on. If I can be of assistance to you, you can reach me at drmissy2011@gmail.com. Let’s be about the business of creating Hamilton-sized change in our communities!

Commissioner’s Comments

Sunset Implementation: A Renewed Focus on Public Health
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A major activity for the Texas Department of State Health Services in 2016 was the implementation of Sunset legislation with the goal of refocusing our agency on its core public health mission. The Sunset process has long been an important part of overseeing state agencies and ensuring state government operates efficiently and effectively. Periodic reviews determine whether agencies need to continue to exist and recommend possible improvements.

The Sunset bill passed in 2015 reauthorized DSHS with significant changes. The legislation recognizes that public health is our primary mission and seeks to align our functions with that mission. That means certain parts of the agency – client services, most regulatory functions, state hospital operations, and certain administrative support functions – have been moved or are scheduled to be moved to other state agencies.

Last fall, 79 programs and 604 program-related positions were transferred from DSHS to the Texas Health and Human Services Commission, most notably programs within the Mental Health and Substance Abuse Services division, including community mental health services and substance abuse prevention, treatment and intervention. DSHS is still overseeing the state mental health hospitals, though they will move to HHSC later this year.

Sunset legislation also deregulated tanning facilities, opticians, contact lens dispensers, rendering businesses, and a few other programs, though there are still requirements that apply to those businesses in state law.

Various professional and occupational licensing functions have moved to the Texas Medical Board or the Texas Department of Licensing and Regulation. Some of the occupations are within the allied health profession such as medical physicists, medical radiologic technologists, respiratory care practitioners, and perfusionists. Other occupations include midwives, athletic trainers, dieticians, speech pathologists and audiologists, dyslexia therapists, orthotists and prosthetists, and fitters and dispensers of hearing instruments.

Three independent boards that DSHS currently provides administrative support for, those that regulate social workers, professional counselors, and marriage and family therapists, are currently the subject of their own sunset review, and the Legislature will decide whether they will move to HHSC as currently planned or undergo some other changes.

Over the next several months we will work toward completing the restructuring of our agency. On Sept. 1, 2017, along with state hospitals, the programs that license and regulate health facilities like acute care and psychiatric hospitals, abortion facilities, ambulatory surgical centers, freestanding ERs, substance abuse treatment facilities, and birthing centers will
move to HHSC.

These major changes to our agency will help us operate with a renewed and concentrated focus on improving health and well-being in Texas. We’re currently identifying strategic goals and priorities that emphasize public and population health. Some goals we have identified include enhancing public health through prevention and population-health strategies. As we further refine our agency’s mission, we look forward to continuing to work with our partners as we respond to new challenges in the New Year.

Poison Control News

Snow Globes: A Potential Christmas Hazard
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Although poison centers receive calls throughout the year, exposures to certain substances or products may occur more frequently around certain holidays. For instance, mistletoe and poinsettia ingestions are more likely to occur during the Christmas season.1,2

Snow globes, transparent fluid-filled spheres, often made of glass or plastic, containing miniaturized scenes, are commonly used as Christmas decorations.3 Once containing fine fragments of bone or porcelain in distilled water, snow globes now contain calcium carbonate in distilled water with glycerol to slow the fall of the fragments. To reduce the risk of freezing, snow globes may also contain as much as 20% ethylene glycol (antifreeze).3,4 Although review of the literature found no serious adverse effects or alcohol poisoning after ingestion of the contents of snow globes, coughing, mouth ulcers, pruritus, rash, and abnormal blood results have been reported.3 Deaths of pets also have been reported after ingesting the contents of a snow globe.4

During 2000-2015, 219 snow globe exposures were reported to the Texas Poison Center Network. One hundred (45.7%) were reported during November-January, with 51 (23.3%) reported during December alone. The United Kingdom (UK) poison center program observed that 46% of their snow globe exposures during 2008-2014 were reported in December-January.3 The patients were 183 (83.6%) age 0-5 years, 17 (7.8%) 6-19 years, and 17 (7.8%) 20 years or more. Similarly, 94% of the snow globe exposures reported to the UK poison center program involved patients less than five years.3 Females accounted for 113 (51.6%) of the patients and males for 106 (48.4%).

The most common route of snow globe exposure was by ingestion (n=182, 83.1%) followed by dermal contact (n=49, 22.4%), ocular (n=10, 4.6%), and inhalation (n=6, 2.7%). (An exposure may occur by more than one route.) The majority (n=216, 98.6%) of the exposures were unintentional and occurred at the patient’s own residence (n=212, 96.8%).

The majority (n=202, 92.2%) of the patients were managed on site (outside of a healthcare facility), and 16 (7.3%) were already at or en route to a healthcare facility when the poison center was contacted or were referred to a healthcare facility by the poison center. The distribution by medical outcome was 60 (27.4%) no effect, 13 (5.9%) minor effect, 65 (29.7%) not followed and judged as nontoxic, 71 (32.4%) not followed with minimal effects expected, and ten (4.6%) had other or unrelated outcomes.

Specific adverse clinical effects, such as diarrhea, vomiting, fever, ocular irritation or pain, erythema, and nausea, were reported in very few exposures. The most common treatments were dilution or wash (n=150, 68.5%) and food or snack (n=13, 5.9%).

Most snow globe exposures reported to the Texas Poison Center Network were not serious and were successfully managed outside of a healthcare facility. However, considering the potential risk of toxic ethylene glycol exposure, particularly among young children, poison centers and other healthcare providers might want to warn the public about accidental ingestion of the contents of snow globes, particularly around the Christmas season when such exposures are more likely to occur. Parents and other childcare providers should remain vigilant if young children have access to snow globes. If a snow globe breaks, children and pets should be kept away while the contents are collected and disposed of safely.5 If a child or other person ingests the contents of a snow globe, consider contacting the poison center at 1-800-222-1222. If a pet ingests the contents of a snow globe, consider contacting a veterinarian.

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Recommended Interventions to Reduce the Risk of Iron Deficiency in Blood Donors
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ABSTRACT
Numerous studies indicate that US blood donors, especially women, have a high prevalence of iron deficiency. Iron is lost with each blood donation, and since donors are eligible to donate blood every eight weeks, it is a challenge to maintain iron balance in frequent blood donors. Prior to blood donations, donors are screened for anemia but not for iron deficiency. Several interventions have been considered to address this public health issue including deferral from donation due to decreased iron stores measured by ferritin levels, iron replacement therapy, education for donors regarding their iron status, extension of inter-donation interval, and restriction of number of donations within a year. A combined approach of education, to encourage donors to take iron supplements and to seek the care of their physicians when necessary, and iron replacement therapy, to replace the iron lost in blood donation, is recommended to address this public health issue.

INTRODUCTION
Iron is an essential nutrient necessary for cognitive development and function, immune status, physical capacity, and work performance of adults and children. Iron is a component of heme in hemoglobin, which binds and transports oxygen throughout the body and is also necessary for certain enzymatic reactions. Iron deficiency is the most common nutritional deficiency worldwide. It is the most prevalent nutrient deficiency in developed countries. Iron deficiency can result in decreased immune and mental function as well as reduced physical performance.

Anemia is a condition in which the body does not have enough healthy red blood cells to carry adequate oxygen to its tissues. Iron deficiency anemia, caused by a shortage of iron in the body, is the most common type of anemia worldwide. The World Health Organization (WHO) estimates that two billion people worldwide are anemic, most due to iron deficiency. The association of iron deficiency with diminished cognitive function is well established. In young children, iron deficiency has been shown to be associated with poor psychomotor performance and short term memory, changes in behavior, irritability, and reduced responsiveness to stimuli. Iron deficiency anemia is also responsible for poor pregnancy and perinatal outcomes in women.

Iron deficiency is a disorder that, without treatment, progresses through three stages: Stage one involves decreased iron stores, which is clinically diagnosed by a decrease in serum ferritin. There is no decrease in hemoglobin levels at this stage and therefore no anemia. Stage two of iron deficiency involves iron deficient erythropoiesis, which is defined by an inadequate quantity of iron to form heme, an essential component of hemoglobin. There is no anemia present at this stage, but decreased ferritin and microcytosis (decreased red cell volume) are clinical indicators of iron deficiency. Stage three is defined by decreased iron stores and iron deficiency anemia.

BACKGROUND
Epidemiology of iron deficiency in the US
The Centers for Disease Control and Prevention (CDC) collects data on the prevalence of iron deficiency in the US using the National Health Nutrition and Examination Survey (NHANES). The CDC reported that the prevalence of iron deficiency in men 16 to 69 years of age was 1% in 1988-1994. The prevalence of iron deficiency was highest in women ages 12-49 years old at 11% (95% confidence interval (CI): 10.0,11.0). In 1999-2000, the prevalence of iron deficiency increased to 12% in women and 2% in men but iron deficiency anemia was reported in only 4% and 1% of women and men, respectively. This trend of high prevalence of iron deficiency continued in the NHANES survey 2003-2006 in women ages 12 to 49 years old. After 2002, women 12-49 years of age were selected as a high risk group, and data collection for all other groups was discontinued by NHANES. Iron deficiency is more common in women due to menstruation, pregnancy, childbirth, and breastfeeding.

The estimated prevalence of iron deficiency prior to 2003 was based on the three indicator model including ferritin, transferrin saturation, and erythrocyte protoporphyrin. However, prevalence estimates starting in 2003 were computed using a new model called the body iron model, which includes the measurement of serum Transferrin Receptor (sTfR) along with ferritin. Serum ferritin was utilized in both models and is the most sensitive indicator of iron deficiency. The prevalence of iron deficiency was calculated, based on serum ferritin level, from 2003 to 2010 using available NHANES data and was found to have increased from 11% to 14.8% (95% CI: 13.7,6,15.84) in women ages 12-49 years. The analysis was conducted using SAS 9.4.

Iron deficiency impacts all racial/ethnic groups, but some are more likely to be affected than others. Prevalence of iron deficiency in Mexican American (22%) and African American (19%) women was twice that of Non-Hispanic White (10%) women in 1999-2000. The same trend of iron deficiency
was observed across racial/ethnic groups in NHANES 2003-2006. Moreover, people who have had blood loss, such as those who have experienced gastrointestinal bleeding or undergone major surgery or trauma, are also at risk for developing iron deficiency.

Public Health Problem
Iron deficiency can develop in frequent blood donors. Blood donors are routinely screened for anemia by fingerstick hemoglobin testing prior to every donation. However, this test does not test for iron deficiency, which is diagnosed based on decreased ferritin levels. Hemoglobin screening for anemia is only effective in diagnosing late stages of iron deficiency. Serum ferritin is the most readily available biomarker for the assessment of iron stores and is a sensitive marker for iron deficiency. Based on WHO criteria, ferritin levels of <15 μg/L in adults indicate depleted iron stores. Sensitivity of ferritin testing is 89% for diagnosis of iron depletion compared to hemoglobin testing, which is only 26%. Due to the current hemoglobin screening process, iron deficient donors with acceptable hemoglobin levels continue to donate blood, further depleting their iron stores by 200 to 250 mg with each whole blood donation. Although there is acknowledgement by the blood bank community that regular blood donations may result in iron deficiency, routine testing for iron status has not yet been implemented. This may be due to increased costs for laboratory testing, fear of losing donors due to logistic inconveniences or operational complexities, or challenges and risks of recommending or providing iron replacement therapy to donors.

Donors provide a valuable service by donating their blood, which is utilized to save the lives of those that need blood transfusions. It is important to monitor donor well-being in order to protect their health and to maintain a healthy donor pool.

Blood Donor eligibility criteria in the US
Whole blood and blood component donation eligibility criteria are established and enforced in the US by the Food and Drug Administration (FDA) and AABB (formerly known as the American Association of Blood Banks). Blood donors may donate whole blood every eight weeks or six to seven times a year and double red blood cells every 16 weeks or up to three times per year. All donors undergo screening for vital signs along with anemia, which is based on fingerstick hemoglobin or hematocrit testing, prior to donation. Decreased hemoglobin indicates anemia, which can be caused by a number of conditions, such as chronic kidney disease, cancer, hematological disorders such as thalassemia and hemorrhagic diseases, and does not always reflect decreased iron stores. In 2016, the FDA revised donor requirements and mandated a minimum hemoglobin of 13.0 g/dL instead of the previously acceptable level of 12.5 g/dL for males. The minimal acceptable hemoglobin for females remained 12.5 g/dL but could be lowered to 12.0 g/dL if the blood establishment took additional steps deemed acceptable by the FDA to assure that donor safety was maintained. The impact of these changes on the prevalence of iron deficiency in blood donors remains to be seen.

Epidemiology of iron deficiency in blood donors
Iron deficiency is not a new problem in blood donors and is one that has been studied for several decades. One of the earlier studies was conducted by Simon and colleagues where they reported that iron deficiency in first time male blood donors (n=505) was non-existent and was 12% in first time female donors (n=516). However, repeat donors contributed to an overall iron deficiency prevalence of 8% in male and 23% in female donors. Reduced iron stores were defined as ferritin of <12 ng/mL in this study. The higher prevalence of iron deficiency in female donors was attributed to menstruation. These findings were later confirmed by other studies.

The Retrovirus Epidemiology Donor Study-II (REDS-II) Donor Iron Status Evaluation (RISE) study assessed iron deficiency, defined by absent iron stores (AIS) as measured by ferritin level of <12 ng/mL, and iron deficient erythropoiesis (IDE) which was defined by log (soluble transferrin receptor/ferritin) of ≥ 2.07. From the 2,425 donors enrolled in the study, 15% of donors reported AIS and 42% reported IDE prior to donation. All donors, excluding the 10% that were deferred due to low hemoglobin, were required to donate a unit of whole blood. This study reported that 66% of female and 49% of male frequent blood donors, defined as women who had donated two or more times a year and men who had donated three or more times a year or equivalent double red blood cell donation in the US, had IDE. Of these, 27% of females and 16% of males had AIS. Gender, donation frequency, and country of birth as well as female age were significantly associated with iron deficiency. Female donors were 1.8 times more likely to have AIS and 2.8 times more likely to have IDE than males, when standardized for age, menstrual status, and pregnancy. Female donors that were younger than 29 years old were 3.1 to 3.9 times more likely to have AIS and 3.1 to 4.9 times more likely to have IDE compared to those that were 40-49 years old. Frequent donors with seven to nine donations in the past two years were 13.5 times more likely to be iron deficient while those with less than or equal to four donations were 5.3 times more likely to be iron deficient compared to first time donors. Previous studies had reported similar findings as well. Asians had a lower prevalence of iron deficiency (p=0.03) than White, African American, and Hispanic donors, but the difference was not statistically significant.

An earlier phase of REDS-II conducted a demographic analysis on 715,000 blood donors from its six blood centers from 2006 to 2007. This study reported 13% donor deferral due to low hemoglobin. Women were 11 times (17.7% vs. 1.6%) more likely to be deferred due to low hemoglobin than men. Women in all age groups had a higher rate of deferral compared to men. Women of childbearing age and those over the age of 60 years had a higher rate of deferral than post-menopausal women between the ages of 51 to 60 years. In men, the odds of deferral increased 1.5 times with each increase in age of ten years in all age groups. Moreover, the odds of African Americans being deferred due to low hemoglobin were reported to be more than twice as much as Whites.

A study conducted in Denmark reported that 13% of male

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blood donors had ferritin levels of <30 ug/L and 1.5% had levels of <15 ug/L. Of the female donors, 43% had ferritin levels of <30 ug/L and 11% had levels of <15 ug/L. Iron supplements were offered to 82% of the donors, those who were iron deficient and those deferred due to anemia. There was no requirement for donor follow-up, which makes it difficult to assess the effectiveness of iron supplementation, but the study reported that a very small number of the donors voluntarily reported that they had low hemoglobin due to medical conditions such as leukemia, cancer, thalassemia, and anemia of chronic disease.28

A higher prevalence of iron deficiency in blood donors is common worldwide and is of particular concern in premenopausal women due to ongoing monthly blood loss and pregnancies. Frequent blood donors are constantly at risk of iron deficient erythropoiesis, which can result in iron deficiency anemia.28 Donor screening for iron deficiency and deferral due to decreased hemoglobin can prevent the onset of and complications of anemia. A primary prevention approach to prevent iron deficiency would result in maintenance of a healthy donor pool. Several interventions have been suggested to address iron deficiency in blood donors.

INTERVENTIONS FOR REDUCING IRON DEFICIENCY IN BLOOD DONORS

AABB has provided recommendations to blood collection organizations regarding management of iron deficiency in blood donors, which include screening for serum or plasma ferritin levels, extension of the inter-donation interval and restriction of the number of donations within a year, education for donors regarding their iron status, and iron replacement therapy.30,31 These recommended interventions are merely suggestions and are not actually common practice during blood donations. Some of these interventions have been introduced at the population level to reduce iron deficiency in blood donors and their effectiveness has been evaluated.

Screening for serum/plasma ferritin
Ferritin is a more sensitive test for identifying iron deficiency compared to hemoglobin. However, ferritin testing may result in deferral of half of the frequent donors, as suggested by the RISE study, and would negatively impact the donor pool.12 Screening of blood donors at first and every tenth donation thereafter with serum/plasma ferritin was implemented in Denmark in 2012. Testing was conducted more frequently if hemoglobin or ferritin levels were abnormal at previous donation. Overall, 1.5% of male and 43% of female donors had ferritin levels of <15ug/L and would have required deferral.28 However, the effectiveness of this deferral in mitigating iron deficiency in blood donors is questionable. No studies have reported the impact of screening with ferritin without supportive iron supplementation.

Donation frequency and inter-donation intervals
The AABB guidelines allow blood donors to donate blood every eight weeks in the US. Simon et al. agreed with this recommendation for men but suggested that menstruating women should be limited to one or two donations per year due to their higher incidence of iron deficiency.8 This study also reported that donors become significantly more iron deficient with each increase in donation frequency.5,24 Similar findings were reported by other investigators,20,25 including the RISE study, which concluded that the number of donations was the strongest predictor of iron deficiency. Frequent donors that donated blood less than four times in the last two years were 5.3 times more likely to be iron deficient and those that donated seven to nine times were 13.9 times more likely to be iron deficient compared to first time donors.24,12

Blood donors in the United Kingdom and several other European countries can donate blood every 12 weeks if they are male and every 16 weeks if they are female, and their minimal acceptable levels of hemoglobin are also higher than acceptable levels in U.S (12.5 g/dL for women and 13.5 g/dL for men).32,33 Donors in New Zealand can donate up to four times a year.14 The RISE study looked extensively at the inter-donation intervals and reported that an interval of less than 14 weeks was significantly related to higher likelihood of AIS or IDE than donating after 14 weeks.12 The results of this study suggest that it takes at least three months and maybe longer to replenish the iron lost in a whole blood donation. There are no studies that compare the impact of donor frequencies and inter-donation variation worldwide.

Education and iron supplementation
Iron supplements are available over the counter and are generally recommended for people that have decreased ferritin levels. Simon et al. reported that female blood donors that take iron supplements had significantly higher iron stores than those that do not take them (p<0.002).8 This was true even if the supplements were not taken regularly. It was recommended that menstruating women that donated more than three times a year should consistently take iron supplements.8 Similar findings were reported by Mast and colleagues in a recent randomized blinded placebo-controlled clinical trial where frequent blood donors were randomized into five groups: iron status informational letter, two different doses of iron supplements, placebo, or no information.27 The results of this study indicated that the mean ferritin level increased by 10.3 ng/mL in the educational information group, 18.3 ng/mL in the low dose supplement group, and by 16.7 ng/mL in the higher dose supplement group (p<0.0001). There was a 70% decline (p<0.002) in the proportion of subjects with iron deficiency (ferritin <12 ng/mL) due to iron therapy. The iron status of those in the placebo group or ones that did not receive any intervention either got worse or remained unchanged.27 These results indicate that low dose iron therapy is more effective than educational information, but both result in improvement of iron status of blood donors. Several other studies have findings that support iron supplementation in blood donors.12,35-38

DISCUSSION AND RECOMMENDATIONS
Iron deficiency anemia is one of the major causes of blood donor deferral.24 Based on current guidelines, persons with iron deficiency can continue to donate until they become anemic.

The US national blood supply is dependent on donors who repeatedly donate blood to fulfill the transfusion needs of the population. It is generally believed by donor centers that re-
recruitment of new donors is more cost-effective than managing iron deficiency in existing donors. However, despite recruitment efforts, 70% of donors are repeat donors, and therefore, are at risk for iron deficiency. The increasing prevalence of iron deficiency in donors suggests that current blood donation guidelines have failed to protect donors. Some interventions that were considered in various studies to manage iron deficiency in donors include screening with serum/plasma ferritin, limiting donation frequency and/or inter-donation intervals, and supplementation of lost iron at each donation.

Determining the iron status of blood donors before every donation using ferritin testing would be ideal. However, assay performance as well as the defined reference ranges for the diagnosis of iron deficiency vary by testing methodology and populations. Other barriers to screening donors using ferritin testing, besides assay characteristics, may include expense of testing, instrumentation requirements, and operational resources. A point of care test that can be performed to obtain quick results, especially for mobile donor settings, would be best for donor testing, but such a test is not available at this time. There are also several unanswered questions, such as frequency of testing, type of test to be utilized, and counseling regarding iron deficiency. In the current environment, deferral of every donor with decreased ferritin would negatively impact the donor pool and may result in decreased availability of blood for those who need it. Screening using ferritin would only be helpful if a low ferritin level triggers an intervention to address the iron deficiency such as an educational intervention or iron replacement therapy.

Based on a literature review, it is clear that an inter-donation interval of eight weeks is not adequate to replenish iron stores. Guidelines from other countries include donation intervals from 12-16 weeks, but there are no studies to show that this practice is effective in reducing iron deficiency in donors.

There is a concern by some in the blood bank community that offering oral iron replacement tablets to blood donors after each successful donation would be risky for a donor who had undiagnosed hereditary hemochromatosis. In hemochromatosis, there is an increased absorption of iron which can lead to iron overload. Although the effects of giving low dose iron replacement tablets to blood donors with hemochromatosis has not been studied, it has been postulated that these donors might absorb more iron than necessary from the tablets. Therefore, if a donor center chooses to give or recommend iron replacement for blood donors, it would be important to initially screen each donor with a one-time ferritin test so those with undiagnosed hemochromatosis or iron overload could be identified and deemed ineligible for iron replacement therapy.

After considering all the available interventions to mitigate iron deficiency in blood donors, iron replacement makes sense. It is imperative that the iron loss from donation is replaced to negate the effect of the blood donation. Therefore, 19 mg iron replacement therapy, which is proven to be 70% effective in reducing iron deficiency, should be provided to every donor for 60 days or eight weeks so they have the opportunity to replace the lost iron before they are eligible to donate again. A one-time serum ferritin test to evaluate the donor’s iron status should be performed, so donors with increased iron stores can be deferred from this therapy and referred to their physicians for follow-up, and those with decreased iron stores could be alerted via a follow-up letter. The letter would also serve as an educational tool that would strongly encourage donors to take iron supplements if needed or to be evaluated by their physicians if they have increased iron stores.

A combined intervention of screening, iron replacement, and education will be more effective in addressing iron deficiency than any single intervention. We urge the FDA and AABB to include this approach in their guidelines and to encourage continuous evaluation of iron status in blood donors.

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Gender Differences in Human Papillomavirus Vaccination Series Completion Rate Among Children and Adolescents in West Texas

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An abstract was submitted and accepted for poster presentation during the 4th annual Gender-Specific Medicine and Women’s Health Symposium sponsored by the Laura W. Bush Institute for Women’s Health, in Lubbock, Texas, October 23, 2015 (abstract was published in the Gender Specific Medicine & Women’s Health Symposium 2015 eBook). The same abstract was also submitted and accepted for oral presentation at the Southern Society for Pediatric Research (SSPR) annual meeting, New Orleans, Louisiana, February 20, 2016 (was published in the meeting memoirs at the Journal of Investigative Medicine, Volume 64, Number 2, February 2016).

ABSTRACT

Introduction: The purpose of this study was to explore gender differences in Human Papillomavirus (HPV) vaccine completion rates among children and adolescents in academic outpatient pediatric clinics in West Texas. Methods: Current Procedural Terminology (CPT) codes were used to identify HPV vaccination in patients ages 9-18 years in four outpatient pediatric clinics in Lubbock, Texas, between January 1, 2010- October 31, 2014. Gender, age, race/ethnicity, and number of HPV vaccines that each patient received were collected. Results: A total of 1147 (51.2%) females, and 1092 (48.8%) males initiated HPV vaccination (p=0.24). There was a statistically significant difference in the age of initiation between females and males (12.3±1.93 years vs. 12.8±1.99 years; p=0.001). Five hundred fifty-nine (25%) received three or more doses, 274 (12.2%) completed the series within 12 months, and only 26 (1.2%) had optimal series completion within six months. More females than males received three or more doses of the HPV vaccine (304 vs. 255; X² =4.29, p<0.05) and received them within 12 months (157 vs. 117; X² =5.84, p<0.05). Conclusions: Males started HPV vaccination at older age than females and were less likely to complete the three dose series than females.

INTRODUCTION

Human Papillomavirus (HPV) is the most common sexually transmitted disease in the world. As of 2014, about 11-12% of people were infected with it worldwide, with 79 million Americans infected and about 14 million new infections every year. HPV causes genital warts as well as anal, cervical, oropharyngeal, penile, vaginal, and vulvar cancers and is so prevalent that about 85% of American women and 91% of American men will be exposed to HPV in their lifetimes. A quadrivalent HPV vaccine was approved for women in the USA in 2006 and for men in 2009. The Centers for Disease Control and Prevention (CDC) recommend beginning the three injection series at age 11-12 years for both boys and girls but the series may begin as early as nine years of age. The second dose should occur one-two months after the first and the third should be given six months after the first one, per current CDC recommendations. There have been many studies demonstrating the difficulty with completion of the vaccination series in the USA. A prior study performed on adults suggested gender differences in initiation and completion of the vaccine series. This study intends to explore gender related initiation and completion rates of the HPV vaccine series in children and adolescents at academic pediatric clinics in West Texas.

Population and Methods

After obtaining Institutional Review Board (IRB) approval, children and adolescents, ages 9 to 18 years, who initiated HPV vaccination series in any of the four outpatient pediatric clinics associated with Texas Tech University Health Sciences Center in Lubbock, Texas, were included in the study. Patients were identified by the Current Procedural Terminology (CPT) code (90649) related to HPV vaccination between January 1, 2010, and October 31, 2014, from outpatient billing data. Gender, age, race/ethnicity, and number of HPV vaccines each patient received were collected from the same data set. Vaccination was considered complete if the three HPV doses were given within 12 months, and optimal if given within six months of the initial dose. Statistical analysis was performed using SPSS software version 22. Demographic data was expressed as mean ± standard deviation (SD), and frequencies (%). The differences between males and females were analyzed using the Student’s t-test for continuous data and with Chi Square for categorical data. A p value of <0.05 was considered statistically significant.

RESULTS

A total of 2,239 children and adolescents - 1147 (51.2%) female, and 1092 (48.8%) male - initiated HPV vaccination during the study period (p=0.24). There was a statistically significant difference in the age of initiation of the HPV vaccine in years between females and males (12.3±1.93 years vs. 12.8±1.99 years; p<0.001). Of those initiating the vaccination series, 559 (25%) received three or more doses (304 females and 255 males), 274 (12.2%) completed the series within 12 months, and 26 (1.2%) had optimal series completion. More females than males received three doses of the HPV vaccine (304 vs. 255; X² =4.29, p<0.05), and received them within 12 months (157 vs. 117; X² =5.84, p<0.05). This gender difference in vaccine completion was only statistically significant among whites as seen in table 1.

DISCUSSION

Though the HPV vaccine was approved for males three years later than for females, there was no gender difference in the initiation of the vaccine among children and adolescents studied. However, as noted in other studies, the completion rate in our population was significantly lower in males than in fe-
males. Also, the HPV vaccine completion rate was only 25%, lower than reported in other parts of the USA and Texas. Interestingly, this gender difference was only observed among whites but not among Hispanics or blacks. Without subject interviews, any explanation for this racial difference would be mere speculation. Additionally, in this study, females started vaccination series at an earlier age than males. This may have contributed to the difference as earlier initiation has shown to be associated with higher rates of completion.¹⁰

Further studies looking into differences in knowledge and attitudes towards the HPV vaccine among adolescents, parents, and medical providers might help elucidate the nature of the gender and racial differences found in this region. In addition, provider recommendation has been linked to initiation of the HPV vaccine series, but little is known about the impact of this on completion of the series.³ Some other reasons cited in the literature for not vaccinating were parents’ lack of knowledge of the vaccine, not feeling like it was needed, and feeling the patient was not sexually active.³

Several strategies could increase initiation and completion rates. Text message reminders have shown to increase HPV vaccine completion rate from 40% to 82% compared with parental education alone.¹¹ Pairing the HPV vaccine to other vaccines like the Tetanus/Diphtheria/Acellular Pertussis (Tdap) or the meningococcal vaccine (MCV4) might improve uptake and completion of the HPV vaccine series.¹² Lastly, a recent study found that a two dose vaccine regimen elicited titers that were non-inferior to a three dose regimen,¹³ suggesting the possibility of changing the recommendations in the future. Our study showed nearly half of the patients received two doses of the vaccine versus one-fourth that received three doses. Reducing the number of vaccine doses might be a viable alternative if further studies support it. Provider recommendation is vital for initiation and completion of the HPV vaccine series; however, the importance of early initiation and the variety of illnesses the vaccine can prevent are not known to many providers, so improving provider education would also be valuable.⁷ There were no gender specific recommendations found to improve initiation and completion rates, but strategies to improve rates among all patients should be encouraged.

Limitations of this study were directly related to the retrospective nature of the study and the use of CPT billing codes to identify those patients that initiated and completed the HPV vaccination series. The study did not offer any information about the use of Cervarix and/or Gardasil 9 as the only vaccine code used in the study was the one associated to Gardasil 4. (To our knowledge, the only vaccine used in all four pediatric clinics was Gardasil 4). Also, because billing codes were the only means of patient inclusion, we were unable to determine the percentage of eligible patients that did not initiate the

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**Table 1. Human Papillomavirus (HPV) vaccine completion rates by gender and race/ethnicity**

<table>
<thead>
<tr>
<th></th>
<th>All n (%)</th>
<th>Female n (%)</th>
<th>Male n (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPV vaccine³</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPV vaccine one dose only</td>
<td>2239 (100.0) *</td>
<td>1147 (51.2)</td>
<td>1092 (48.8)</td>
<td>0.24</td>
</tr>
<tr>
<td>HPV vaccine two doses</td>
<td>1055 (47.1)</td>
<td>517 (49.0)</td>
<td>538 (51.0)</td>
<td>0.5</td>
</tr>
<tr>
<td>HPV vaccine three doses</td>
<td>625 (27.9)</td>
<td>326 (52.2)</td>
<td>299 (47.8)</td>
<td>0.28</td>
</tr>
<tr>
<td>HPV vaccine four or more doses</td>
<td>552 (24.7)</td>
<td>300 (54.3)</td>
<td>252 (45.7)</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>7 (0.3)</td>
<td>4 (57.0)</td>
<td>3(43.0)</td>
<td>NA</td>
</tr>
<tr>
<td>HP vaccine series completion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three or more doses completed within any time frame</td>
<td>559 (25.0)</td>
<td>304 (54.4)</td>
<td>255 (45.6)</td>
<td>0.038</td>
</tr>
<tr>
<td>Three or more doses completed within 12 months of the first dose</td>
<td>274 (12.2)</td>
<td>157 (57.3)</td>
<td>117 (42.7)</td>
<td>0.016</td>
</tr>
<tr>
<td>Three or more doses completed within six months of the first dose</td>
<td>26 (1.2)</td>
<td>15 (57.7)</td>
<td>11 (42.3)</td>
<td>0.43</td>
</tr>
<tr>
<td>HPV vaccine series completion by race/ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whites</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three or more completed within any time frame</td>
<td>832 (37.2) **</td>
<td>455 (54.7)</td>
<td>377 (45.3)</td>
<td>0.007</td>
</tr>
<tr>
<td>Three or more doses completed within 12 months of the first dose</td>
<td>224 (26.9)</td>
<td>128 (57.1)</td>
<td>96 (42.9)</td>
<td>0.033</td>
</tr>
<tr>
<td>Three or more doses completed within six months of the first dose</td>
<td>108 (13.0)</td>
<td>69 (63.9)</td>
<td>39 (36.1)</td>
<td>0.004</td>
</tr>
<tr>
<td>Hispanics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three or more completed within any time frame</td>
<td>642 (28.7) **</td>
<td>304 (47.4)</td>
<td>338 (52.6)</td>
<td>0.18</td>
</tr>
<tr>
<td>Three or more doses completed within 12 months of the first dose</td>
<td>156 (22.3)</td>
<td>91 (51.9)</td>
<td>75 (48.1)</td>
<td>0.63</td>
</tr>
<tr>
<td>Three or more doses completed within six months of the first dose</td>
<td>69 (10.7)</td>
<td>37 (53.6)</td>
<td>32 (46.4)</td>
<td>0.547</td>
</tr>
<tr>
<td>Blacks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three or more completed within any time frame</td>
<td>288 (12.9) **</td>
<td>134 (46.5)</td>
<td>154 (53.5)</td>
<td>0.239</td>
</tr>
<tr>
<td>Three or more doses completed within 12 months of the first dose</td>
<td>57 (19.8)</td>
<td>25 (43.9)</td>
<td>32 (56.1)</td>
<td>0.35</td>
</tr>
<tr>
<td>Three or more doses completed within six months of the first dose</td>
<td>24 (8.3)</td>
<td>11 (45.8)</td>
<td>13 (54.2)</td>
<td>0.683</td>
</tr>
<tr>
<td>Other, or No Answer</td>
<td>477 (21.2) **</td>
<td>254 (53.2)</td>
<td>223 (46.8)</td>
<td>0.168</td>
</tr>
</tbody>
</table>

**£ Human Papillomavirus Vaccine**

*Number (%) of patients who received HPV vaccine

**Number (%) of patients who identified as White/Hispanic/Black/Other-No Answer who received HPV vaccine
series. As we tried to eliminate any recall bias, information about who was counseled about the vaccine or offered it and who refused it was not obtained. The study included four academic outpatient pediatric clinics in Lubbock, Texas, which might limit the ability to generalize the results to other cities in Texas or in the USA.

REFERENCES

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A Note from the TPHA Section Leaders!

There are many opportunities to get involved in your section. Please contact any of the following leaders at txpha@aol.com Attention: [name of section leader], to find out how. Not a member of a section yet? Contact the person in the area you are most interested in. **Don’t forget to attend the section business meetings at the Annual Education Conference!**

Beverly Pritchett, Administration & Management Section (2017)
James Swan, PhD- Aging & Public Health Section (2017)
Teresita Ladrillo, Oral Health Section (2017)
Phani Veeranki, Epidemiology Section (2017)
Debra Flores, Health Education Section (2017)
Monica Hughes, Public Health Nursing Section (2017)
Alisa Rich, PhD, Environmental and Consumer Health Section (2017)
Yetunde (Nola) Akiwowo, Student Section (2017)
cigarettes (e-cigarettes). Smoking and smokeless tobacco use patterns are typically established during the adolescent years. Nearly 9 out of 10 adult cigarette smokers began smoking before the age of 18,1,4 and smokeless tobacco use also almost always begins by the time youth graduate from high school. The peak years for first initiation appear to be grades six and seven (or between the ages of 11 and 13), with some starting even earlier.9 Further, among those who currently use tobacco, one-half of males and almost one-third of females report using more than one tobacco product in the past 30 days.6 This early tobacco use often becomes a strong addiction that can overwhelm attempts at cessation. Clearly, any strategies to decrease future tobacco use must be three-pronged: helping current users quit, preventing occasional users from becoming addicted regular users and preventing youth from experimenting with tobacco-related products.9 If the decline in cigarette use among teens is to continue, full implementation of comprehensive tobacco control programs must be combined with reductions in advertising and commercial availability of tobacco-related products.2,10

Emergence of E-cigarettes
While use of most forms of tobacco has been decreasing, the increase in use of e-cigarettes is a recent phenomenon with some positive benefits, but also some potential concerns for both public health and clinical medicine.11 Electronic cigarettes are the most common type of electronic nicotine delivery systems (ENDS).12 These products deliver nicotine in the form of a vapor inhaled by the user (known as the ‘vaper’). They contain an atomizer that converts the contents of a nicotine cartridge into a vapor when heated and a battery-operated heating element to produce the heat for the atomizer. The heating and vaporization may be initiated by pressing a button or by inhalation by the user. E-liquids may be similar in taste to tobacco or may contain other flavoring (mint, coffee, chocolate, etc.) and are sold as replaceable cartridges, refill liquids, or as one-use disposable e-cigarettes. Unlike conventional tobacco cigarettes, the vaporization does not cause combustion and tobacco smoke. As with any novel product, different brands of e-cigarettes with various versions of the devices are available. They are often fashioned to look like cigarettes, pipes, and cigars, but may also have the appearance of common items (e.g., pens, memory sticks) so as not to bring attention to their use in some cases or in other cases as a matter of novelty or personal.12-14 After being developed in China in 2003, e-cigarettes entered the U.S. market in 2007.12,13 Awareness of and interest in e-cigarettes increased rapidly among potential consumers.15-17 In 2013, 50 percent of U.S. smokers had tried e-cigarettes, up from 32 percent just one year earlier.12 While the overall use patterns of e-cigarettes are unclear, use appears to be highest among current smokers, those with higher education and income, non-Hispanic whites, as well as among young adults.16,18 Increased use of e-cigarettes

ABSTRACT
The decline in smoking over that last half century has been a significant public health achievement in the U.S. The emergence of e-cigarettes may hold potential for aiding smoking cessation efforts, but may also create new opportunities for nicotine experimentation. This paper reviews the emerging e-cigarette industry, its marketing approaches, and recent steps to regulate labeling, distribution and advertising. It summarizes current research on the efficacy of e-cigarettes as smoking cessation aids as well as their potential health effects. It also discusses how young people might be particularly vulnerable to the allure of these new products. Finally, it outlines steps prevention specialists and health educators, especially those working with young people, could take to respond to this new trend.

Key words: e-cigarettes, vaping, risk prevention, adolescents

BACKGROUND
The recent decline in smoking over the last half century is considered an important public health success.1 The proportion of adults who report smoking in the U.S. has decreased from 42.4% in 1965 to 17.8% in 2013, and the percentage of high school students reporting smoking has declined from a high of 36.0% in 1997 to 9.2% in 2014.2 While these smoking declines have significantly improved the health profile of Americans, they still fall short of the Healthy People 2020 goal of 16.3 In 2011, the percent of Texans who currently smoke was 19.2 and the percent of youth in grades 9-12 was 17.4, higher than national averages.4 With about one-sixth of the population currently smoking, clearly there is still room for improvement.1 Tobacco use remains the single most preventable cause of disease, disability, and death in the United States, with an estimated 443,000 people dying prematurely each year from smoking or exposure to secondhand smoke, and another 8.6 million living with a serious illness caused by smoking. Though not posing as great a risk, smokeless tobacco products also increase risk for death or disease, beyond the above mentioned totals. In addition to these mortality and morbidity risks, users also bear the physical, psychological, and financial burden of nicotine addiction, with millions of Americans continuing to use tobacco-related products despite the health risks.5

LITERATURE REVIEW
Early Tobacco Experimentation
Every day in the U.S., more than 3200 teens under the age of 18 smoke their first cigarettes, and each day, approximately 2100 youth and young adults who have been occasional smokers become daily cigarette smokers.6 In 2012, 6.7% of middle school and 23.3% of high school students reported current use of tobacco products. These products included not only cigarettes, but also cigars, snus, smokeless tobacco, hookahs, pipes, bidis, kreteks, dissolvable tobacco, and electronic devices.
is partly the result of increased advertising for the products.\textsuperscript{19} Though television and radio have not been important venues for tobacco advertising since the 1970's, these products have been aggressively marketed through other channels, including online marketing. Advertising of e-cigarettes accelerated with the acquisition of e-cigarette brands by and competition among major tobacco companies.\textsuperscript{20, 21} Sales from e-cigarettes rose rapidly from $250 million in 2011 to nearly $1 billion by 2014.\textsuperscript{22, 23} However, there seems to be some disagreement as to the size of the industry because it is difficult to capture the magnitude of online sales. Nielson estimated that 2015 brick-and-mortar sales were $850 million (though this may be hard to estimate with small vape shops opening and closing frequently). Wells Fargo estimates, that if online sales are included, the total market was over $2.5 billion in 2015.\textsuperscript{24} Late 2015 and early 2016 data showed declines in convenience store sales and reports that major tobacco companies may be losing interest in this segment of the market.\textsuperscript{25}

\textbf{Youth and Vaping}

Data from the most recent National Youth Tobacco Survey show that current e-cigarette experimentation (i.e., “have you ever tried an electronic or e-cigarette...”) among middle and high school students tripled from 2013 to 2014, increasing from 4.5 to 13.4 percent, which translates in to 1.3 million more high school and 300,000 thousand more middle school students trying them. The authors noted that this is the first time in survey history that current e-cigarette use has surpassed current use of every other tobacco product overall, including conventional cigarettes.\textsuperscript{26, 27} The 2014 Texas Youth Tobacco Survey reported that nearly one-fourth of all middle and high school students reported lifetime e-cigarette use, and 14% reporting using e-cigarettes in the last 30 days. What’s more, nearly one-fourth of current e-cigarette users had never smoked conventional cigarettes.\textsuperscript{28} What we can’t tell from these data is whether this is one-time experimentation or the beginning of regular use. Due to several factors, including ease of operation set up, low financial investment, and minimal advertising requirements, sources estimate that more than half of all e-cigarettes are sold on the internet. With no current direct regulation, internet marketing offers an easy pathway of selling to youth. According to a recent Morbidity and Mortality Weekly Report (MMWR), about seven out of every ten middle and high school students reported some exposure to e-cigarette advertisements in 2014. The authors expressed concern about whether viewing these advertisements might lead to increased use of e-cigarettes among teens (Singh et al., 2016).\textsuperscript{29} As discussed below, the adverse effects of nicotine may be particularly pronounced in adolescents. There is concern that e-cigarettes may increase nicotine addiction among youth and that they might lead youth to try other tobacco-related products.\textsuperscript{14, 30}

\textbf{Regulation}

While the United States Food and Drug Administration (FDA) has regulated cigarettes, cigarette tobacco, smokeless tobacco, and roll-your-own tobacco products for years, until recently, e-cigarettes have not been regulated as a specific tobacco product.\textsuperscript{31} In early 2016, the FDA submitted a request to the Office of Management and Budget to extend its authority to regulate additional nicotine-containing products. Effective August 2016, the new regulation bans e-cigarette sales to minors under age 18 and will require stronger warning labels starting in 2018.\textsuperscript{32, 33} The rule does not ban internet marketing, where a significant portion of sales are thought to occur,\textsuperscript{34} but does require reliable age verification for online sales. Perhaps the most controversial part of the new rules is a requirement for pre-market review of any new devices, which requires e-cigarette makers to assure that they are safe. Some contend that such pre-market reviews will be prohibitively expensive and may prevent forth-coming product improvements.

Many states, including Texas, were ahead of the federal government in regulating the sale of e-cigarettes. Texas, Senate Bill 97 became law in Late 2015. The most prominent parts of the law prohibit sale of e-cigarettes to minors and require age verification for online sales to Texas residents. The state law goes beyond FDA rules by making the use of these products by minor a Class C misdemeanor resulting in a fine and mandatory tobacco education. Further, it prohibits second-hand exposure to vapor in public buildings, including, schools, elevators, theaters, libraries, and public transportation.\textsuperscript{35}

Because there has been no previous federal oversight of e-cigarettes, which would require the FDA to fully evaluate them for safety, there are many unanswered questions about the safety and efficacy of these products.\textsuperscript{14, 22} For example, limited studies by the FDA have revealed issues with substandard or non-existent quality control over these products. Findings included mislabeling of the nicotine content (some labeled as containing no nicotine were found to have nicotine and varied inhaled nicotine content were found in products bearing the same label).\textsuperscript{14} The FDA has previously warned some e-cigarette manufacturers for making unsubstantiated claims and for poor manufacturing processes as a violation of the Federal Food, Drug, and Cosmetic Act (FDCA).\textsuperscript{14}

\textbf{Safety}

A systematic review of early chemical, toxicological, and clinical studies showed that chemical exposures from e-cigarettes are much lower than those resulting from tobacco smoke and are lower than those allowed by the FDA in other situations.\textsuperscript{36} Because there is no tobacco combustion in an e-cigarette, some manufacturers and distributors have claimed that their products are a safer alternative to conventional cigarettes. However, these claims have been rejected by the FDA.\textsuperscript{37} Because these products have been unregulated, the nicotine levels and other contents of e-cigarettes vary greatly and, as mentioned earlier, are not always consistent with the label.\textsuperscript{38, 39} Further, some e-cigarettes are reported to contain varying amounts of other compounds that are potentially harmful to humans, including nitrosamines and diethylene glycol, though not likely to the same degree as smoked tobacco.\textsuperscript{30} It has also been shown that cells exposed to the vapor from e-cigarettes show unhealthy changes similar to, though not as dramatic as, cells exposed to tobacco smoke.\textsuperscript{41} The authors of the aforementioned systematic review conclude their
These potential ill-effects of e-cigarettes have led to warnings by the FDA about the risks of unregulated sales on the Internet and a Surgeon General report stressing the need for quantifying the level of risk for long-term use of non-combusted sources of nicotine, especially if long-term use of these nicotine sources becomes more common. As discussed above, increased use of these products is clearly occurring.

Though not common, there are other potential safety issues secondary to intended use. FEMA reported at least two dozen verifiable incidents of e-cigarette devices exploding or catching fire, at least nine resulting in injury. The CDC has noted an increase in poisoning related to mishandling of refillable liquids, most in children under the age of five.

Nicotine

Although the FDA has recently concluded that nicotine replacement products do not pose high risk for abuse or dependence, nicotine is addictive and may hold some potential health risks, though not as many as smoked tobacco products. In The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General, the summary of findings shows a likely link between nicotine and an increase in heart rate, an increase in myocardial contractility, an increase in coronary vascular resistance, and a decrease in insulin sensitivity, all contributing to increasing cardiovascular risk in nicotine users.

It is not clear if nicotine is a carcinogen in humans, but it is known to affect deregulation of biological processes including angiogenesis, which might promote the growth of existing tumors. Being bioactive for a number of carcinogenic mechanisms in experimental systems, nicotine might be associated with increased rates of oral, esophageal, or pancreatic cancer. Nicotine has also been linked to other possible ill-health impacts including affecting cellular immunity and mediating adverse effects of smoking on reproductive health (including preterm delivery, stillbirth, and other adverse health outcomes for the developing fetus).

The adverse effects of nicotine may be particularly pronounced in adolescents. Based on animal studies, knowledge of adolescent brain development, and limited studies from young smokers, it is possible that nicotine exposure during adolescence adversely affects cognitive function and development. Therefore, the potential long-term, cognitive effects of exposure to nicotine in youth are of great concern. There is also a body of evidence that suggests the higher sensitivity to nicotine among adolescents can create dependence sooner than for adults. Specifically, those with earlier initiation of smoking are more likely to develop greater nicotine addiction than those who start at a later age. The majority of those who smoke during adolescence are addicted by age 20. This addictive behavior is likely to continue into adulthood. This extended use, in turn, increases the risk of long-term, health consequences. Unfortunately, many of these addicted youth report wanting to quit but being unable to do so.

Cessation

Like the evidence on the long-term effects of e-cigarettes, information on the impact of e-cigarettes on smoking cessation is also inconclusive. Based on current available research, e-cigarettes cannot be promoted, at this time, as providing any benefit in smoking cessation.

Nicotine is an addictive psychoactive drug. Pharmaceutical medications and nicotine replacement therapy (NRT) have been shown to increase smoking quit rates. However, even with the use of NRT, the percentage of smokers who return to smoking within six months is reported through meta-analysis to be 93.48 As an electronic nicotine delivery system (ENDS), e-cigarettes provide varying amounts of nicotine. The efficacy of e-cigarettes as an alternative nicotine delivery system has been posited and claims have been made that e-cigarettes may be helpful for smoking cessation. If true, these products may play an integral role in the ongoing fight against smoking.

However, evidence of e-cigarettes as a smoking cessation aid through controlled trials and large cross-sectional studies is currently scant. A few reports supporting effectiveness show increased abstinence using e-cigarettes compared to traditional methods or ‘cold turkey’. Some studies report cessation rates from 22.5 to 70 percent with additional smokers reducing their cigarette consumption by as much as 50%. Other studies have supported the effectiveness of e-cigarettes in reducing the craving for cigarettes, even suggesting that the mere presence of the smoking stimuli without the presence of nicotine may reduce cravings.

Conversely, other studies show that e-cigarette users are less likely to be totally abstinent from cigarettes than those who have never used e-cigarettes and that, despite reducing total cigarette consumption, e-cigarette users were no more likely than cigarette smokers to have quit smoking permanently. Further, Bullen et al. report that e-cigarette users achieved similar abstinence as those using nicotine patches, but that dual use (simultaneously using NRT and tobacco products) persisted longer with e-cigarette users than patch users. A systematic review of 38 studies published in Lancet Respiratory Medicine found no benefit for using e-cigarettes as a smoking cessation aid (though some researchers are debating the rigor of the studies included). Thus, some in the medical community are suspicious of the therapeutic claims of e-cigarettes, and some medical organizations currently discourage practitioners from counseling their clients to use e-cigarettes as a primary cessation avenue until further supportive evidence is available. Though it’s too soon to tell, there is some encouraging news from the National Health Interview Survey showing that while 12.6% of Americans tried an e-cigarette in 2014, only 3.4% of non-smokers have tried one and only 0.4% of people who never smoked a combustible cigarette currently used an e-cigarette, hopefully suggesting
that current adult non-smokers don’t seem to be attracted to the product.⁵⁹

An interesting framework for quantifying the total public health impact of e-cigarettes was recently proposed by Levy et al.⁶⁰ Taking an epidemiologic approach, they suggest a sequence of questions that must be answered before we can determine whether this product should be viewed primarily through a harm reduction or risk prevention lens. Firstly, we must ask about the proportion of users: current smokers, former smokers or those who have never smoked. Then, we must try to determine what would have happened in the absence of the e-cigarette option. For example: Would non-smokers have been attracted to some nicotine product anyway? Would current smokers have given up smoking anyway? Thirdly, we must ask how long each behavior would have continued: how long they would have abstained, how long they would have used the e-cigarette product and how long they would have smoked. Finally, we must determine the final status of users: no nicotine, only e-cigarettes, only smoking, or dual use. As can be observed from this list of questions, these products could lead to a total increase or decrease in harm, depending on the proportions in each category. However, until we have longitudinal data to accurately answer these questions, it seems prudent to take a very cautious approach.

**Implications for Risk Prevention**

The health promotion community must understand these trends in e-cigarette use and health professionals who work with youth must respond to changing tobacco and tobacco-like product trends. Clearly, health professionals should not rely solely on e-cigarette industry claims regarding the health benefits of their products. While this approach, aimed at risk reduction, is commendable and not without merit when properly implemented, health promotion professionals, especially those who work with impressionable youth, must keep risk prevention emphasized in the mission of tobacco education efforts.

Should conclusive evidence be presented and these products be approved as a smoking cessation tool, then that avenue of cessation should be offered just as any other cessation method is currently – with accurate pros and cons, statistics that represent true and total cessation figures as compared to other cessation methods, and prescriptions or other controls on the sale of these cessation products. And if shown to be effective in ‘harm reduction’ for some smokers, that information should also be presented in tobacco education. However, reducing the number of cigarettes smoked or replacing one form of nicotine addiction for another, though improving overall health, should not be the ultimate goal of health promotion. Though smoking fewer cigarettes or inhaling fewer toxins is a step forward in the fight against tobacco-related death and disease, we should not be satisfied substituting this lesser goal for our original goal of eliminating nicotine-related addiction, disease and death.

As proposed by the Surgeon General, by Levy et al., and others, future research must focus not only on the long-term health effects of ENDS, but also on the long-term use patterns and how users transition from use of one nicotine product to another and to no use.⁶⁰ It is will be important to understand the answers to these long term questions. Do adolescent ENDS experimenters continue to be life-long users? Do current smokers who use ENDS eventually give up smoking? Do current smokers eventually give up nicotine? Do former smokers come back to their nicotine habits because they perceive ENDS as less harmful?

Just as it has been expanded to include smokeless tobacco (and other forms of tobacco administration), tobacco education must now include content on e-cigarettes. Youth must understand that there are no harmless, nicotine-related products, and this includes e-cigarettes. Despite the fact that they are non-combusting and produce no smoke, the emissions and nicotine content of these products is not without risk. Although the emissions from e-cigarettes likely contain fewer toxic compounds than the smoke from cigarettes, it is too early to conclusively determine the long-term effect of inhaling these heated vapors. Plus, the nicotine delivered has potential health risks that must not be overlooked. We should not be deceived. Early onset of the use of any nicotine containing product is likely to lead to increased nicotine dependence among users. In school health education, youth should be taught that the nicotine in these products is an addictive drug and should be classified with the other addictive substances in the drugs unit of the curriculum. Youth should also be taught that inhaling anything, except clean air, into their lungs presents potential short- and long-term risks. ‘Safer’ than cigarettes does not mean ‘safe’.

As revenue from conventional tobacco products continues to decline in the U.S., health professionals should expect the influence of the powerful tobacco industry in the e-cigarette market. In the process, they should also expect the emerging e-cigarette industry to seek creative marketing strategies for adults that will also appeal to youth (despite regulations against specifically targeting youth), just as the tobacco industry has done with other tobacco products in the past.

Educators should understand that youth are enamored by novel products. The fun delivery devices and variety of flavors might hold special appeal to youth to try these new products, particularly when they may have heard they are harmless and when they are being advertised as trendy and sophisticated. Young people are uniquely vulnerable to the powerful influence of advertising, and perhaps more so than adults to the exposure of internet advertising, where much of the e-cigarette marketing is expanding.

**REFERENCES**


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High Frequency Patient Analysis to Identify Disparities Associated with Emergency Department Utilization in Dallas County

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ABSTRACT
Objective: Socio-economic, demographic, cultural and environmental inequalities have been reported as determinants of non-urgent use of emergency department (ED). This study aimed to quantify the utilization characteristics of emergency department usage in Dallas County hospitals and to develop an analysis of high ED-utilizing patients using zip codes and “hot blocks”.

Methods: This study used out-patient ED data for 21 Dallas County hospitals from the Dallas-Fort Worth Hospital Council Foundation’s database. Spatial analysis and GIS mapping with ED data was used for high-utilizer patients was used to identify a “hot block” representing patients with the most visits.

Results: In 2012, total 912,302 outpatients ED visits were made by 544,149 patients in Dallas County hospitals. In 2012, total charges for outpatient ED visits were $2,487,677,034. Based on NYU logarithm, nearly 66 percent of ED visits ideally might be treated in an outpatient venue other than the ED. “Hot spot” analysis enabled us to select zip codes representing the highest ED visits and further investigate the characteristics of those residents who were high ED utilizers.

Conclusion: This study identifies characteristics associated with high ED usage in Dallas County. The study also demonstrates the value and potential public health benefits of health care data-sharing. In the future, we encourage health care data-sharing in order to coordinate care between health care and public health providers ensuring higher quality individual case management.

INTRODUCTION
One in every five Americans has at least one visit to the emergency department (ED) each year.1 Emergency departments play a key role in the delivery of healthcare services to all people regardless of insurance status or ability to pay for medical needs.2 According to US Census Bureau, Texas has the highest number of uninsured people (24.6 percent) in the United States. In Dallas County 33.1 percent of its residents are uninsured.3 However, the ED is not optimal setting for many presenting conditions. Unnecessary use leads to overcrowding and longer wait times, which adversely affect the processes and quality of care.4-6

Socio-economic, demographic, cultural, and environmental disparities have been reported as determinants of non-urgent and excessive use of emergency services.7-11 Literature suggests that compromised quality of care, endangered patient safety, impaired staff morale and increased cost of care may result. Additionally, many urban, poor people prefer going to a hospital for care rather than a doctor’s office because of a perceived higher quality than that provided in an ambulatory care setting, including the social and emotional support provided by hospitals which many of these patients lack in the community.12 Patients, who have traditionally been dependent on ED’s and hospital clinicians, may not understand the importance of the physician-patient relationships available in a patient-centered “medical home” because they have never experienced care in such a setting. During the past few years, a variety of innovative interventions, public health efforts, and community-based case management programs have been implemented to reduce ED overcrowding.13

Lack of an integrated healthcare database has been identified as a major barrier to future planning of health care related areas such as expected patient numbers, required workforce, quality and safety measures, total charges, cost estimation, community level health care efforts, and public health research. The DFWHC Foundation has built (since 1999) a comprehensive patient data registry that is capable of providing information regarding ED usage, patient charges, and demographic characteristics of the patients from the North Texas region.

Dallas is the largest city in North Texas with a rapidly increasing population and changing demographics.14 Historically, Dallas’ population was predominantly white (not-Hispanic whites made up 82.8 percent of the population in 1930) but has become diversified as a result of population growth, especially in the last few decades.15 A report published by DFW international in 2010 highlighted the diversification of population in Dallas with 30.10 percent whites, 43.10 percent Latino, 23 percent African American and 2.40 percent Asian residents.14 This report also suggested that approximately 26.10 percent of residents in Dallas were new Americans (foreign-born). Over one million new people moved to this area during the past 10 years. In addition, for 43.20 percent of the population, English is not their primary language.14

To our knowledge, no attempts have been made to investigate characteristics related to emergency department usage in Dallas County. Geographic Information System (GIS) mapping and spatial analysis have been very effective tools for health care research in identifying disparities and to critically examine the issues, strengths, and challenges inherent in disease prevalence and current community and/or hospital-based healthcare.16 Recognizing the need to investigate the emer-
The objectives of our research were:
1. To identify utilization characteristics including demographics and charges for emergency department visits in Dallas County during the past 3 years (2010, 2011 and 2012).
2. To develop a “High ED utilization Analysis” for Dallas County through a more detailed analysis including zip codes and a “hot blocks” analysis for the year 2012.

METHODS

The Dallas-Fort Worth Hospital Council Research and Education Foundation (DFWHC Foundation) securely houses the combined data warehouse created in 1999 by the North Texas hospital systems which contains information for over 10.7 million regional patients and more than 51 million hospital encounters. This warehouse collects data from 95 percent of the hospitals in North Texas including 21 hospitals from Dallas County. These records reveal demographic data, payer types, up to 25 diagnoses and surgical/testing procedure codes, charges, current procedural test (CPT) codes, severity of disease, and other information. With the regional enterprise master patient index (REMPI), the Foundation assigns a unique identifier to all patients, allowing the Foundation researchers to track any patient over time by hospital and by payer. For this study, the data for all patients who visited an emergency department of any hospital in Dallas County (21 hospitals) during 2010, 2011 and 2012 were extracted from the DFWHC Foundation’s data warehouse. Only out-patient data were used for high ED utilization analysis. For race and ethnicity, our dataset uses the standard classification used by the US census 3 and the Texas Health Care Information Council (THCIC), which was created by the 74th Texas Legislature in 1995 and functions under the direction of the Department of State Health Services. http://dshs.texas.gov/thcic/default.shtml. This classification categorizes race as black/white or Caucasian/Asian or Pacific Islander/American Indian/Eskimo/Aleut/others and ethnicity as Hispanic or Latino/Not Hispanic or Latino.

A validated New York University Emergency Department (NYU) visit severity algorithm was used to classify visits to the ED based upon diagnosis.17 This algorithm classifies the ED diagnosis in different categories. Namely, emergent: ED care needed (not preventable/preventable), emergent: primary care treatable, non-emergent, injury, mental health, alcohol, substance abuse, intermediate, others/unclassified (none of above). Diabetes prevalence was compared with HCUP statistical brief for diabetes patients in US hospitals (https://www.hcup-us.ahrq.gov/reports/statbriefs/sb167.jsp).

To achieve the first objective, the data from 2010, 2011 and 2012 for Dallas county hospitals were analyzed to obtain a descriptive view of the county. For the second objective, the data from 2012 for Dallas county hospitals and Zip Atlas were used to perform the more in depth zip code “hot” spot analysis. The Arc GIS mapping system (ArcInfo version 10.0, ESRI, Redlands, CA) was used to combine ED visits with their corresponding zip codes for the year 2012. Zip code information from zip Atlas (http://zipatlas.com/us/texas.htm) was used for the analysis. This study was the first pilot attempt to investigate high ED utilizers in the Dallas county using two regional data registries. Similar to the method used in the study by Camden, 30 and based on the highest ED utilization, three zip codes from total 104 zip codes of Dallas County were selected for further hot block analysis. The analysis was limited to 3 zip codes due to funding restrictions for this pilot study. Hot blocks (also known as hot spots) in this study refer to the identified residential blocks representing the highest ED visits within a zip code. The combination of our data and GIS analysis also pinpointed individual, high ED utilization patients (also known as “hot spotters”), which was defined as patients who made more than one visit to the ED in one calendar year. This spatial analysis with data from 2012 not only facilitated access to high ED utilization patients, but also helped to identify the characteristics of the high ED utilizers. Data were analyzed using software SPSS19 (IBM SPSS Inc., Chicago IL).

EMS data for 2012 were used for data matching with DFWHC Foundation’s data to confirm hot blocks (Table 3) in selected zip codes. EMS data were provided by the Dallas Fire-Rescue Department’s billing agency the BioTel EMS system. The billing database was queried to determine the highest ED utilization addresses for all 9-1-1 calls during the study period. This research study was approved by the North Texas Health Information and Quality Collaborative (NTHIQC) which approved the research methodology and the patient/hospital confidentiality protection for all research projects conducted by the DFWHC Foundation.

RESULTS Statistics, demographics and charges of emergency department visits (adult and pediatric) in Dallas County hospitals during three years (2010, 2011 and 2012)

In Dallas County hospitals, the average emergency department visits rate per 1000 patients has been relatively stable with 1590, 1643, and 1671 visits per year for 2010, 2011 and 2012 (Table 1). During 2010-2012, results showed that the total charges for ED visits increased from $1,851,037,156 to $2,487,677,034 (Table 1). The New York University emergency department (NYU) visit severity algorithm indicated a stable profile of ED cases during these three years. This includes 10 percent emergent not-preventable and 66 percent of total visits were treatable outside the ED (Figure 1). ED visits related to mental health, alcohol and substance abuse increased from 19,730 in 2010 to 30,107 in 2012. In Dallas County, the highest number of ED visits were made by patients with no insurance (38 percent) followed by patients with Medicaid (29 percent). Additionally, 22 percent of these ED visits were made by patients with commercial insurance and 11 percent were by patients with Medicare.
Table 1: Statistics of Emergency Department visits in Dallas County in 2010 - 2012

<table>
<thead>
<tr>
<th>ED visits by year</th>
<th>Dallas</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Outpatients*</td>
<td>461,158</td>
<td>502,141</td>
<td>544,149</td>
</tr>
<tr>
<td>ED Outpatient cases**</td>
<td>732,345</td>
<td>822,495</td>
<td>912,302</td>
</tr>
<tr>
<td>ED cases per 1000 patients</td>
<td>1590</td>
<td>1643</td>
<td>1671</td>
</tr>
<tr>
<td>Percent Diabetes Prevalence***</td>
<td>13.8%</td>
<td>13.9%</td>
<td>14.1%</td>
</tr>
<tr>
<td>ED cases by Females</td>
<td>391,804 (53.5%)</td>
<td>444,147 (54%)</td>
<td>501,766 (55%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adult vs. Pediatric Patients</th>
<th>Average Age (Adult/Pediatric)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>46 / 7</td>
<td>45 / 7</td>
<td>42 / 6</td>
</tr>
<tr>
<td></td>
<td>ED Cases (Adults/Pediatric)</td>
<td>509,299 / 223,046</td>
<td>583,244 / 239,251</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Payer Group</th>
<th>Insured</th>
<th>138,543</th>
<th>172,753</th>
<th>204,765</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medicaid</td>
<td>199,963</td>
<td>226,412</td>
<td>268,717</td>
</tr>
<tr>
<td></td>
<td>Medicare</td>
<td>85,234</td>
<td>87,464</td>
<td>89,087</td>
</tr>
<tr>
<td></td>
<td>Uninsured</td>
<td>308,605</td>
<td>335,855</td>
<td>349,733</td>
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</table>

<table>
<thead>
<tr>
<th>Charges</th>
<th>Total Charge</th>
<th>1,851,037,156</th>
<th>2,185,046,204</th>
<th>2,487,677,034</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Case Charge</td>
<td>2,528</td>
<td>2,657</td>
<td>2,727</td>
</tr>
</tbody>
</table>

*number of out patient emergency department patients during 2010-2012.

** number of ED visits made by these unique patients during 2010-2012.

*** [https://www.hcup-us.ahrq.gov/reports/statbriefs/sb167.jsp](https://www.hcup-us.ahrq.gov/reports/statbriefs/sb167.jsp)

Figure 1: Percent NYU Categorization of Emergency Department Visits in Dallas County during 2010-2012
Emergency department utilization analysis for Dallas County hospitals (2012)

Zip code analysis using 2012 data: The highest ED utilization zip codes 75216, 75217, and 75243 from Dallas County were selected for further analysis (Map 1). These zip codes had nearly double the ED visits per 1000 patients (3200) than the Dallas County average. More visits were made by females in these zip codes than males. Residents from zip codes 75216 and 75217 had a higher diabetes prevalence (15 percent and 16.1 percent) than the national average i.e. for diabetes is 9.1 percent and 12.6 percent for diabetes related ED visits (Table 2).

When compared with the census data for zip code 75216, whites made more ED visits per capita than other races. Whites in this zip code made nearly 3 visits per resident (3,220 ED visits by 1,121 residents) whereas, 43 percent of black residents visited ED (13,914 ED visits by 32,538 residents). Based on ethnicity, Hispanics/Latinos made up 40 percent ED visits (adjusted for population) and the remainder were by non-Hispanics.

For the zip code 75217, census race data indicated 28 percent black and 38 percent white residents. In 2012, black residents made up 62 percent of the total ED visits. Only 27 percent ED visits were made by whites. Nearly 65 percent of residents in the zip code 75217 were Hispanic/Latino and they made up 38 percent of the total ED visits.

Zip code 75243 had 41 percent black, 28 percent white and 26 percent Hispanic/Latino residents. Our results indicated that black patients made more ED visits (57 percent) compared to others. Non-Hispanics/Latino made more visit (78 percent) as compared to Hispanics.

Payer information indicated that these zip codes have the highest percentage of uninsured ED patients (40 percent visits in 75216; 48 percent visits in 75217; 42 percent visits in 75243) followed by Medicaid and Medicare patients. Based on the NYU analysis, 66 percent of ED visits from these zip codes were manageable outside ED. Table 2 presents the total and average charges (the average being $2415 per ED visit in 2012) for ED visits from these zip codes.

Hot blocks analysis using 2012 data: Block analysis identified the residential blocks within these zip codes with high ED visits using the addresses of the patients who were high ED utilizers. Data from DFWHC Foundation and Dallas-Fire Rescue confirmed these addresses as hot blocks. Table 3 indicates the number of patients and their EMS calls (Dallas-Fire Rescue data) and ED visits (DFWHC Foundation’s data). In addition to these, Dallas-Fire Rescue data also showed that 14 percent-19 percent of the patients were treated on site and were not transported to a hospital ED.

Map 2 shows the high (in red) and moderately high (in green) ED visit hot blocks in zip codes 75216, 75217, and 75243. Table 3 demonstrates the characteristics of selected patients who were high ED utilizers (based on DFWHC Foundation’s data) residing in identified blocks in selected zip codes. The average age for ED visits varied from 34 to 39 years for adults and 4 to 7 years for children. Percentages of pediatric ED visitors in these hot blocks ranged from 21 percent to 57 percent. Hot blocks were characterized by more ED visits by black patients (48 percent to 70 percent) and non-Hispanics (72 percent-84 percent). Data from the ED visits from these blocks showed that only 26 percent-37 percent were emergent visits (including preventable and non-preventable as well as primary care treatable) and average charges ranged from $1837 to $2522 per visit.

High emergency department utilization analysis: Table 4 shows the characteristics of high ED utilization patients in zip codes 75216, 75217, and 75243. The number of ED visits by these high ED utilization patients ranged from 17 to 62 vis-
Table 2: Statistics and Demographic Information of high ED visit Zip codes in Dallas County in 2012

<table>
<thead>
<tr>
<th>County</th>
<th>75216</th>
<th>75217</th>
<th>75243</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Patients*</td>
<td>6,954</td>
<td>7,615</td>
<td>6,423</td>
</tr>
<tr>
<td>ED cases*</td>
<td>22,500</td>
<td>23,839</td>
<td>20,688</td>
</tr>
<tr>
<td>ED cases Male/Female</td>
<td>9222/ 13278 (59.4% Female)</td>
<td>8989/ 14850 (62% Female)</td>
<td>7519/ 13169 (64% Female)</td>
</tr>
<tr>
<td>% Diabetes Prevalence in ED visitors (number of cases with Diabetes)</td>
<td>15% (3027)</td>
<td>16.1% (2943)</td>
<td>16.2% (1991)</td>
</tr>
<tr>
<td>Dialysis/end stage kidney complications</td>
<td>1.18% (266)</td>
<td>0.77% (184)</td>
<td>0.42% (87)</td>
</tr>
<tr>
<td>Adult vs. Pediatric Patients</td>
<td>Average Age (Adult/Pediatric) Cases (Adult/Pediatric)</td>
<td>43 / 5</td>
<td>40 / 5</td>
</tr>
<tr>
<td>Race</td>
<td>Black</td>
<td>13,914</td>
<td>7,716</td>
</tr>
<tr>
<td></td>
<td>Other***</td>
<td>5,351</td>
<td>9,566</td>
</tr>
<tr>
<td></td>
<td>Asian or Pacific Islander</td>
<td>3,220</td>
<td>6,520</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>American Indian / Eskimo / Aleut</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Hispanic or Latino</td>
<td>6,061</td>
<td>8,937</td>
</tr>
<tr>
<td></td>
<td>Not Hispanic or Latino</td>
<td>16,439</td>
<td>14,902</td>
</tr>
<tr>
<td>NYU****</td>
<td>Emergent*****</td>
<td>7,316</td>
<td>7,625</td>
</tr>
<tr>
<td></td>
<td>Indeterminate Injury</td>
<td>5,391</td>
<td>5,960</td>
</tr>
<tr>
<td></td>
<td>2,734</td>
<td>2,986</td>
<td>2,673</td>
</tr>
<tr>
<td></td>
<td>Non-emergent</td>
<td>2,810</td>
<td>3,017</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>4,248</td>
<td>4,252</td>
</tr>
<tr>
<td></td>
<td>Insured</td>
<td>2,927</td>
<td>2,991</td>
</tr>
<tr>
<td></td>
<td>Medicaid</td>
<td>7,549</td>
<td>8,203</td>
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<tr>
<td></td>
<td>Medicare</td>
<td>3,126</td>
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</tr>
<tr>
<td></td>
<td>Uninsured</td>
<td>8,897</td>
<td>10,159</td>
</tr>
<tr>
<td>Payer Information</td>
<td>Total Charge</td>
<td>53,091,917</td>
<td>59,211,405</td>
</tr>
<tr>
<td></td>
<td>Average Charge</td>
<td>2,360</td>
<td>2,484</td>
</tr>
</tbody>
</table>

*number of out patient emergency department patients during 2012 ** number of ED visits made by these unique patients during 2012 *** Patients other than black or white race/mixed race/ not known or not reported ****A validated New York University Emergency Department (NYU) visit severity algorithm was used to classify visits to the ED based on diagnosis.20 ***** including preventable and non-preventable as well as primary care treatable emergent visits.

its in 2012. NYU analysis revealed that one patient had 81 percent non-emergent visits in 2012 and the average charges ranged from $1909 to $5103 per visit. These patients were in the Medicaid, Medicare and uninsured payer group. Pain, chest pain, headache, abdominal pain and acute upper respiratory infections and bronchitis were the most common primary diagnoses.

Table 5 demonstrates the top ten primary diagnoses of high ED utilization patients from zip codes 75216, 75217, and 75243 during their ED visits in 2012.

**DISCUSSION**

This study provides the first detailed analysis of ED utilization in Dallas County using two key data registries for the area. Our results indicated no significant change in rate of ED visits (ED visits/1000 patients) during 2010-2012 whereas previous studies have reported steady increases in ED visits in United States since the 1990s.8 In addition, percent NYU classification of ED visits in Dallas County during 2010-2012 has been consistent with only 10 percent non-preventable emergent visits. This non-significant increase in ED utilization during the past three years could be partially explained by the recently developed community based, primary care network by public hospital (Parkland Health System) in the low socio-economic status areas. As reported, Dallas Fire-Rescue also treated about 14 percent -19 percent patients in the community in response to their 9-1-1 calls and referred them to community clinics for follow up visits. In addition to the above, long waits
### Table 3: Statistics and Demographic information for the Hot Blocks in Dallas County Zip codes 75216, 75217 and 75243 (2012)

<table>
<thead>
<tr>
<th>Zip code</th>
<th>75216</th>
<th>75217</th>
<th>75243</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot blocks</td>
<td>3500 Block E OVERTON RD</td>
<td>3000 Block E LEDBETTER DR</td>
<td>200 Block STONEPORT DR</td>
</tr>
<tr>
<td>EMS data in 2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(EMS Patients)</td>
<td>290</td>
<td>156</td>
<td>54</td>
</tr>
<tr>
<td>(EMS cases)</td>
<td>636</td>
<td>424</td>
<td>160</td>
</tr>
<tr>
<td>(% Treated onsite and Not Transported)</td>
<td>17%</td>
<td>19%</td>
<td>14%</td>
</tr>
<tr>
<td>ED cases in 2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitals ED Patients*</td>
<td>202</td>
<td>158</td>
<td>155</td>
</tr>
<tr>
<td>Hospitals ED Cases**</td>
<td>525</td>
<td>407</td>
<td>490</td>
</tr>
<tr>
<td>Adult vs. Pediatric Patients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Age (Adult/Pediatric)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases(Adult/Pediatric)</td>
<td>431 / 94</td>
<td>329 / 78</td>
<td>399 / 91</td>
</tr>
<tr>
<td>Race</td>
<td>Black</td>
<td>332</td>
<td>283</td>
</tr>
<tr>
<td></td>
<td>Other***</td>
<td>187</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>&lt;50</td>
<td>&lt;50</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Not Hispanic or Latino</td>
<td>383</td>
<td>338</td>
</tr>
<tr>
<td></td>
<td>Hispanic or Latino</td>
<td>142</td>
<td>69</td>
</tr>
<tr>
<td>NYU****</td>
<td>Emergent***</td>
<td>162</td>
<td>128</td>
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<tr>
<td></td>
<td>Indeterminate</td>
<td>111</td>
<td>117</td>
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<td></td>
<td>Non-emergent</td>
<td>80</td>
<td>54</td>
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<tr>
<td></td>
<td>Injury</td>
<td>69</td>
<td>44</td>
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<tr>
<td></td>
<td>Other</td>
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<td>64</td>
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<td></td>
<td>Average Charge</td>
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<td>1,927</td>
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*number of out patient emergency department patients during 2012
** number of Emergency department visits made by these unique patients during 2012
*** Patients other than black or white race/mixed race/ not known or not reported
****A validated New York University Emergency Department (NYU) visit severity algorithm was used to classify visits to the ED based on diagnosis, including preventable and non-preventable as well as primary care treatable emergent
Map2: Hot Blocks analysis in Dallas County Zip codes 75216, 75217 and 75243
and overcrowding in EDs could also be a reason for diverting insured patients towards their primary care providers or special care facilities.8, 22, 23

According to The Centers for Disease Control and Prevention (CDC), safety-net emergency departments are facilities that provide more than 30 percent of the total ED visits to people with Medicaid, more than 30 percent of the total ED visits involving uninsured individuals, or a combined Medicaid and uninsured patient population greater than 40 percent.18-21 Dallas County hospitals served an average of 68.53 percent combined Medicaid and uninsured patients each year during 2010 (69.44 percent), 2011 (68.36 percent) and 2012 (67.79 percent). In Dallas County hospitals (21 hospitals) during 2010-2012, 38 percent of their ED visits were made by uninsured patients followed by Medicaid, insured, and Medicare patients.

Dallas County had the highest number of ED visits in North Texas during 2012. The highest ED utilization zip codes in Dallas County were 75216, 75217, and 75243. More ED visits were made by females which was a finding consistent with that previously reported by Carret et al 2009.7 Zip code analysis (75216, 75217 and 75243) for 2012 data indicate that only 30-32 percent ED visits from selected zip codes were emergent. Results clearly indicate that 68-70 percent visits were not emergent and could have been treated outside ED. This is higher than previously reported results (43 percent) based upon the urban public hospitals data from Dallas.22

These patients may indicate a lack of access or limited availability to other healthcare options. Studies have reported that this may be a patient’s trust in hospitals compared to local clinics because of issues related to timing, appointment, access, and/or cultural reasons.7, 11 In addition, due to low reimbursement rate and time consuming payment process, acceptance rates for Medicaid and Medicare patients by Texas physicians is very low.3 As reported previously, many urban, poor patients prefer going to a hospital for care rather than a doctor’s office because they perceive hospital care as less expensive and more accessible for them.12 Finally, providers’ and patients’ perspectives of emergent vs non-emergent conditions and the need for utilization of the ED often differ. It may seem appropriate to the patients to use a particular resource or service whereas the provider sees it as abusing the EMS instead of using alternative transport or primary care venues.7, 12, 22 Interventions promoting patient health education has shown significant impact by reduction in inappropriate ED visits, reduced missed days of school for children and missed days of work for adults.23

Non-urgent use of ED utilization has been associated with availability of community-based primary care facilities.7,12,13,23 In high ED visit zip codes such as 75243, patients have limited healthcare options with only one pediatric community practice and no other community healthcare options. Zip code 75216 has 2 community oriented primary care (COPC) clinics, 1 women’s health clinic, 1 pediatric clinic and 1 dental clinic. Zip code 75217 has 1 community oriented primary care (COPC) clinic, 1 youth and family health center, 1 women’s

<table>
<thead>
<tr>
<th>Zip code</th>
<th>75216</th>
<th>75217</th>
<th>75243</th>
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<tr>
<td>ED Visits in 2012</td>
<td>18</td>
<td>17</td>
<td>49</td>
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<tr>
<td>Emergent</td>
<td>5</td>
<td>12</td>
<td>2</td>
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<tr>
<td>Indeterminate</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Non-emergent</td>
<td>3</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Injury</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total Charge</td>
<td>85,624</td>
<td>21,917</td>
<td>93,524</td>
</tr>
<tr>
<td>Average Charge</td>
<td>4,757</td>
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<td>1,999</td>
</tr>
<tr>
<td>Payer Information</td>
<td>Medicare</td>
<td>Medicaid</td>
<td>Medicaid</td>
</tr>
</tbody>
</table>

Table 4: High Emergency Department visits from hot blocks (2012)

* A validated New York University Emergency Department (NYU) visit severity algorithm was used to classify visits to the ED based on diagnosis (20).
** including preventable and non-preventable as well as primary care treatable emergent visits.
health clinic, 1 pediatric clinic and 2 dental clinics. There were a number of physician’s offices in these zip codes but many of these providers do not accept uninsured patients and accept only a very limited number of Medicaid and Medicare patients. As reported earlier, patients often have problems accessing private practices due to limited hours and appointment related challenges. These results highlight the need to develop more community-based health care venues which are easily accessible for extended hours, affordable and culturally competent so that individuals with non-urgent medical conditions may be less likely to delay treatment until an urgent/emergent condition develops. In addition to the above, Kellermann et al 2014 have proposed a model of leveraging the capabilities of modern health information technology, telehealth and training primary care technicians who can expand the impact and reach of patient-centered medical homes by providing basic preventive, minor illness, and stable chronic disease care in rural and resource-deprived communities.

This analysis revealed that the average age of the ED patients from these hot blocks was 31-40 years. These results support the findings published by Carret et al 2007 reporting that inappropriate ED use was higher in the younger age group (15–49 years) compared to the older age group (50 years or older). In Dallas County, this may have been due to the combination of high rate of uninsured patients and the limited health insurance coverage options available to them at the time. In the communities with low socio-economic status, children, pregnant women and the elderly are generally covered by some kind of public or private healthcare coverage (CHIP, Medicaid or Medicare) but young adults and the middle-aged in Texas often have limited options available to them. In addition, simply qualifying for insurance coverage does not solve the problem of access, as these insurance programs often come with many restrictions. Primary care physicians often limit acceptance of these patients due to the lower reimbursement rate compared to that of insured patients.

There are several regulatory barriers to the referral of Medicaid and uninsured patients for specialty care from primary care physicians. Lack of coordination of care and responsibility sharing between different care providers also makes treatment complicated for these patients. In addition to economic reasons, there are social barriers that limit health care access for these patients at primary care clinics (treating the under-served might compromise their clinic’s reputation).

Medicaid expansion was a recent opportunity to cover some of the eligible uninsured Texans (individuals and families earning up to 138 percent of the federal poverty level) into the expanded Medicaid plan. But, Texas’ decision not to accept the federal Medicaid expansion plan left these uninsured patients with the hospital ED as their most accessible healthcare option. These patients, who would otherwise qualify for the Medicaid expansion coverage, may always be ED-dependent because plans offered by the new Affordable Care Act’s may be too expensive, even if it is the lowest-price or with federal subsidies.

According to the National Association of State Mental Health Program Directors Research Institute’s report, in 2012 Texas spent only $38.99 per capita on mental health care compared to the national average of $121.47 per capita, ranking Texas 49th in the country. Our study showed that in 2012, 30,107 ED visits were made because of behavioral health (mental health, alcohol and substance abuse) related problems. In 2012, the total charges of these behavioral health related emergencies were $93,142,056 or approximately $3093.70 per ED visit. Significant increases in behavioral health-related ED visits during the past few years have been associated with a financial burden on Dallas County. Our results indicate an urgent need to address increasing disparities related to behavioral health in specialized settings outside ED. Significant correlations between ED visits and those who are uninsured or Medicaid indicate the economic disparity related to an increased amount of ED visits. Zip code as well as high frequency patient analysis confirms that uninsured and Medicaid were the top two payer groups in high ED visit areas.

Health, socio-economic, racial, ethnic, cultural, and environmental disparities have previously been reported as determinants of non-urgent/excessive use of the ED. Cultural and linguistic competence is widely recognized as a fundamental aspect of quality health care (including mental health), particularly for a diverse patient population like in Dallas, which is home to 26 percent foreign-born residents and where English is not the first language for 43 percent of the population. In this study, black and not Hispanic/ Latino patients made significantly more visits to ED. Cultural and linguistic competence is an essential element for reducing disparities by improving access, decreasing utilization and ultimately improving the quality of care delivered. Studies have documented the impact of a patient’s language deficiency (e.g. limited English proficiency) and racial and ethnic background in accessing and receiving quality healthcare.

The number of visits by high ED utilization patients ranged between 17-69 visits in 2012. The non-emergent visits made by high ED utilization patients ranged from 30 percent to 81 percent with an average cost of $2700 per visit. The top 10 common primary diagnoses of their ED visits were mainly pain (chest pain, headache and abdominal pain), bronchitis, and diabetes related complications. Authors suggest that in addition to expanding culturally-competent and easily accessible primary/community healthcare options and sustainable public health efforts, individualized case management with these patients should be made available. Evidences suggest that the sickest 5 percent of patients account for over half of healthcare costs. Therefore, efforts aimed at the “super-utilizers” (including sickest patients) providing intensive outpatient care management to high-need, high-cost patients are being developed and implemented. In New Jersey, the Camden coalition of healthcare providers developed the first successful model for identifying high-utilizers and providing them with highly coordinated care. Similar successful efforts have been reported by Amarasingham et al 2013 in reducing heart failure related readmissions. Our study also suggests that there is an urgent need for targeted efforts in these hot spots and more importantly with these high ED utilization patients.
in order to manage their health conditions at non-urgent levels to prevent the development of an urgent/emergent condition. Continuing to rely on emergency departments to provide primary care services for these patients is not a sustainable solution. Author Malcolm Gladwell has also discussed the cost and consequences of not addressing public health issues such as homelessness. In his book, he questions the efficacy of continuing to invest resources on programs which are not sustainable, and in some cases may not be ethical.32

In Dallas County, authors have identified that to facilitate the personalized care and case management for these patients the first step could be to revise the legal guidelines of patient privacy and health information laws. Staying within the same objective of maintaining high level confidentiality and respecting patient privacy, adding a scope for consent to treat and do case management in an ethical way to provide coordinated care as a sustainable solution might be an appropriate approach.

**Conclusion and Future Implications**

This study is the first effort to identify characteristics associated with ED usage in Dallas County. This research examined data from two patient data registries (DFWHC Foundation and EMS) in the Dallas area. Results explaining sociodemographic patterns in ED utilization have major significance in terms of public health planning. High/inappropriate ED use is a multi-faceted problem and requires public health approaches focused on patient, provider, community, and healthcare system level changes. With the identification of the social determinants of health in high ED utilization areas, public health efforts and resources can be more efficiently targeted and focused on management of identified inequalities. These results may guide ongoing community and public health programs.

<table>
<thead>
<tr>
<th>Table 5: Top Ten Diagnoses in 75216, 75217 and 75243 in 2012</th>
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</thead>
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<tr>
<td><strong>Dallas County</strong></td>
</tr>
<tr>
<td><strong>75216</strong></td>
</tr>
<tr>
<td><strong>Top Ten Diagnosis</strong></td>
</tr>
<tr>
<td>Acute upper respiratory infections of unspecified site</td>
</tr>
<tr>
<td>Urinary tract infection, site not specified</td>
</tr>
<tr>
<td>Chest pain, unspecified</td>
</tr>
<tr>
<td>Asthma, unspecified, with (acute) exacerbation</td>
</tr>
<tr>
<td>Unspecified otitis media</td>
</tr>
<tr>
<td>Abdominal pain, unspecified site</td>
</tr>
<tr>
<td>Headache</td>
</tr>
<tr>
<td>Chest pain, other</td>
</tr>
<tr>
<td>Other current maternal conditions classifiable elsewhere, antepartum</td>
</tr>
<tr>
<td>Acute pharyngitis</td>
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</table>
in the Dallas area to implement public health promotion programs.

In the future, we support improvements in health information exchange (HIE) in order to coordinate efforts between different stakeholders and, more importantly, to be able to perform case management like the New Jersey-based Camden program. In addition, health policies and information protection laws i.e. HIPPA and PHI may need to be revised in order to facilitate more personalized efforts for efficient public health programs in these communities.

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The authors acknowledge the hard work of the paramedics, firefighters and officers of the Dallas Fire-Rescue Department and other UT Southwestern/ BioTel EMS agencies who care for all our patients regardless of their medical condition or ability to pay with great skills, dedication and professionalism each day.

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