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President's Message

Cindy Kilborn, MPH

I am honored to serve as the 2015-2016 President of Texas Public Health Association (TPHA) for its 92nd year. We have just completed the Annual Educational Conference (AEC), and again it proved to be a very successful and thought provoking experience for all in attendance. We are fortunate to have so many people who remain committed to TPHA, the AEC and public health in general.

As I have been advancing up the leadership ladder of TPHA, it has at times felt a little overwhelming. But, then I have had the benefit of learning so much from the supportive network of members we have in TPHA and this type of participation can only insure the continued success of our association.

Building and sustaining networks is an important topic to embrace for the future of public health. So much so that it was the theme of our most recent AEC; "Optimizing Public Health through Partnerships". This is not a new concept for public health and there have been many successful targeted efforts directed at specific issues among various healthcare agencies in the past. Most efforts have come together for a very specific issue, usually for a specific time period and frequently controlled by funding mandates. These efforts, while successful, are not necessarily sustainable.

What is evolving in the world of public health today is the increasing awareness of the complexities of assuring the public's health and the multifaceted approaches that will be required to accomplish these goals. This year's conference has highlighted projects already in progress and the possibility for further expansion.

These networks and collaborations are not just with public health's traditional partners; hospital communities, pharmacies various groups of healthcare providers (including social services) and institutions responsible for educating the healthcare workforce of the future. These new collaborative networks will include non-traditional partners, such as community planners, policy makers, transportation entities, agricultural producers/distributors and social marketing groups.

What we have to address, what we have to insure, is that the networks we have now and those we begin to build are flexible, expandable and securely placed before an urgent need arises. Most importantly, each must be sustainable while maintaining the integrity and infrastructure of each partner agency.

For some this will necessitate a paradigm shift in order to optimize potential partnerships. It will entail seeking out non-traditional relationships and creating atmospheres of trust and empowerment within and between agencies/organizations. We must support these intersectoral collaborations, emphasize the links between public health and all disciplines and break down silos. Doing so will build partnerships that will promote health equity and increase the efficiency of all entities involved in improving the public's health.

Identification of the true needs of individual communities is paramount to this endeavor. This cannot be accomplished without the benefit of appropriately focused community health assessments (CHAs) and identification and acquisition of relevant data sets. Currently, many local health departments are hampered in their attempts to easily obtain these data sets. Budgets may not include the fees required to purchase specific data (not all data are free access). Some data are only available as aggregated sets at the county level, when many questions require data at a more granular level. Some agencies holding certain data require adherence to very stringent and rigid guidelines with a stated specific research topic. Often this comes with the added limitation of only utilizing these data for a specific time frame. These restrictions are not conducive to the systematic monitoring required to produce evidence based results.

Systematic is the key word here. Monitoring, or more appropriately in public health terms, surveillance, implies an ongoing activity. Surveillance is the ongoing, systematic collection, recording, analysis, interpretation and dissemination of data. Surveillance is the basis of epidemiology (the study of disease in populations) and epidemiology is the science of public health.

The partnerships and networks of communication that we now begin to initiate must also be ongoing. We are creating information loops that start and end with communication. Communication is the key to collaboration and collaboration is the key to successfully addressing the public health challenges of the 21st century.

So, let's get those bulldozers ready and shift that old paradigm right out of the building. Everyone has a role in moving towards this new model of wellness AND everyone's perception of a problem can add to creating a complete picture. I think we can borrow from a slogan coined nearly twenty years ago by the Texas Department of Health (now DSHS)—PUBLIC HEALTH: EVERYONE – EVERYWHERE – EVERYDAY LET'S JUST DO IT!!

Our 91st TPHA Annual Education Conference was a huge success!

If you are not a TPHA member, please join us, we do great things for the health of Texans!

www.texaspha.org

Many thanks to our presenters, organizers, volunteers and exhibitors. Please visit www.texaspha.org and view a special electronic version of the journal that provides all abstracts from the presentations given during this fantastic learning event.

Our Annual TPHA conferences offer an opportunity for our members to learn, to network and take care of association business. We welcomed a new association president, elected new officers, inducted new association fellows, honored Texas' public health powerhouses and voted to pass the association resolutions that are published below.

Standard Resolution A:
Since the 2014 Annual Meeting of the Texas Public Health Association, the death of two of our members has occurred. In respect to the memory of this departed associate, the membership of the Association herein stands in silent tribute to the deceased member, and their deaths will be noted in the official records of the Association.

Ron J. Anderson, MD
Doug Fabio

Standard Resolution B:
The membership of the Texas Public Health Association, highly aware of the time and effort to plan and arrange for the 2015 Annual Educational Conference, wishes to express its gratitude to the Program Planning Committee, chaired by James Swan, PhD, and the Texas Department of State Health Services, Austin, Texas

The Texas Public Health Association also wishes to express its thanks to all our Exhibitors and Sponsors for their most generous and gracious support and contributions to the annual education conference.

Resolution 1 – Cancer Prevention and Research
WHEREAS, more than 119,000 Texans will be diagnosed with cancer and almost 45,000 Texans will die from cancer this year; and
WHERAS, cancer prevention and early detection is an essential component of state efforts to reduce the incidence of cancer; and
WHEREAS, Texas was the one of the first states in the nation to implement a statewide breast and cervical cancer screening and early detection program; and
WHEREAS, cancer has no boundaries and can affect anyone at any time; and
WHEREAS, cancer affects not only patients but also their family and community; and
WHEREAS, the Texas Public Health Association is a member of the Texas Public Health Coalition (coalition), and
WHEREAS, the coalition supports the full funding request for the Cancer Prevention and Research Institute of Texas(CPRIT) and an independent and scientific review of the merit of all CPRIT projects; and
WHEREAS, the coalition supports the Texas Department of Health Services' funding request to assure access to breast and cervical cancer screening and detection for uninsured women; and
WHEREAS, the coalition supports funding for evidence-based interventions to reduce tobacco use; and WHEREAS, the coalition supports comprehensive statewide legislation that eliminates exposure to second hand smoke in all indoor workplaces throughout Texas; now, therefore be it
RESOLVED, that the Texas Public Health Association supports the Texas Public Health Coalition's legislative efforts in the area of 2015 Cancer Prevention and Research Priorities, this 25th day of February 2015.

Resolution 2– Get Texas Moving and Eating Healthy
WHEREAS, overweight and obesity contribute to chronic conditions including diabetes, hypertension, heart disease, cancer and stroke; and
WHEREAS, in Texas chronic conditions account for 3 out of every 4 deaths; and
WHEREAS, we can help reduce and help prevent childhood obesity by improving access to healthy foods and physical activity in schools and childcare centers; and
WHEREAS, physical activity and good nutrition improve a child's academic performance; and WHEREAS, increasing access to healthy foods is important in the community and the workplace as well; and
WHEREAS, good health is influenced by social, economic, and physical factors in a community; and WHEREAS, the Texas Public Health Association is a member of the Texas Public Health Coalition (coalition), and WHEREAS, policies and other resources that support planning and an infrastructure with access to physical activity and healthy foods strengthen a community's health; now, therefore be it RESOLVED, that the Texas Public Health Association supports the Texas Public Health Coalition's legislative efforts in the area of 2015 Healthy Eating and Activity Priorities, this 25th day of February 2015.

Resolution 3 – Vaccinations are Important for all Texans

WHEREAS, 72.5 percent of Texas children 19-35 months are fully immunized; and

WHEREAS, adult vaccinations protect the adult as well as infants and others who cannot be vaccinated; and

WHEREAS, routine vaccination of older and high-risk adults for bacterial pneumonia has shown to decrease preventable hospitalizations from bacterial pneumonia; and

WHEREAS, infectious diseases can easily be reintroduced to Texas' unvaccinated communities; and

WHEREAS, the Texas Public Health Association is a member of the Texas Public Health Coalition (coalition)

WHEREAS, the coalition supports improving public access to information on immunization exemptions in their communities, schools, and daycare facilities and provide information to the public on the incidence of disease; and

WHEREAS, the coalition supports targeting pertussis vaccination information to pregnant women; and

WHEREAS, the coalition supports current and expanded funding for the DSHS Adult Safety Net for vaccination; and

WHEREAS, the coalition supports extending the retention date of state immunization records for post-high school education and employment needs; and

WHEREAS, the coalition supports making de-identified exemption information accessible and reportable to the public; now therefore be it

RESOLVED, that the Texas Public Health Association supports the Texas Public Health Coalition's 2015 legislative efforts in the area of Immunization Priorities, this 25th day of February 2015.

Resolution 4 – Reducing the Toll of Tobacco in Texas

WHEREAS, Texas is the largest state in the U.S. without a 100 percent smoke-free air law; and

WHEREAS, tobacco use comes with a high consequential price tag-estimated to be more than $20 billion including $7.5 billion in direct health care expenditures, almost $5 billion in decreased workplace productivity, and $7.9 billion in premature death; and

WHEREAS, the CDC estimates about 23,000 Texas minors start smoking each year; and

WHEREAS, a key strategy for decreasing smoking attributable illnesses and deaths is by preventing minors and young adults from ever taking up the tobacco habit ; and

WHEREAS, several states have already passed legislation to include e-cigarettes in nonsmoking laws or to restrict the sale of e-cigarettes to minors; and

WHEREAS, the Texas Business Group on Health reports that 90 percent of companies surveyed – representing 400,000 employees – already restrict tobacco use in the workplace and 76 percent ban smoking indoors; and

WHEREAS, the Texas Public Health Association is a member of the Texas Public Health Coalition (coalition), and

WHEREAS, the coalition supports regulation of e-cigarettes as tobacco products including the prevention of youth access; and

WHEREAS, the coalition supports adequate funding for comprehensive statewide tobacco control; and

WHEREAS, the coalition supports comprehensive statewide smoke-free legislation; and

WHEREAS, the coalition supports the adoption of local smoke-free ordinances; now, therefore be it

RESOLVED, that the Texas Public Health Association supports the Texas Public Health Coalition's legislative efforts in the area of 2015 Smoke-Free Priorities, this 25th day of February 2015.

Resolution 5: Make Texas Streets Safer with a Ban on Texting

WHEREAS, 459 people died in Texas last year in crashes caused by distracted drivers; and

WHEREAS, the use of a cell phone while driving increases the likelihood of a crash serious enough to cause injury by four times; and

WHEREAS, people who text and drive are 23 times more likely to be in a motor vehicle crash; and

WHEREAS, sending or receiving a text message takes a driver's eyes off the road 4.6 seconds on average; and WHEREAS, an overwhelming majority of the public (94%) support state laws that ban texting or emailing while driving; and

WHEREAS, only 9 states (including Texas) have failed to enact a ban on texting while driving; and

WHEREAS, the Texas Public Health Association is a member of the Texas Public Health Coalition (coalition); and WHEREAS, the coalition supports adopting a statewide ban on texting while driving; and

WHEREAS, the coalition supports educating the public about the dangers of driving while texting; now, therefore be it

RESOLVED, that the Texas Public Health Association supports the Texas Public Health Coalition's legislative efforts in the area of 2015Make Texas Streets Safer With A Ban on Texting, this 25th day of February 2015.

Commissioner's Comments

Public Health Accomplishments Move Texas Forward

Kirk Cole
Interim Commissioner, Texas Department of State Health Services

As Dr. David Lakey's tenure as state health commissioner came to a close earlier this year, we spent some time taking stock of Texas public health and the accomplishments we've made over time – accomplishments that have been a result of state and local partners working together to improve the health of everyone in Texas.

With the legislative session underway and the agency undergoing Sunset review, now is the time to remember that our daily work matters. Through initiatives big and small, in rural communities and in large urban areas, we keep people healthy and safe and we improve quality of life.

The state's public health infrastructure has improved and evolved over the last decade thanks to the commitment of local and state public health servants. We make a difference in a state that is more than 262,000 square miles in area and has a population of more than 26 million.

As a result of our strong partnerships, the efficient work of our staff and the credibility we've built over time, DSHS' budget has gone from $2.5 billion in 2007 to $3.2 billion now, a 28 percent increase. We've seen increases across the department's programs, with an emphasis on mental health and substance abuse programs and women's health.

We can all agree that a key part of public health is being prepared to meet new challenges as they arise, including outbreaks, disasters, novel viruses and other threats. Our responses to Ebola, West Nile Virus, H1N1, hurricanes, wildfires and countless other natural or man-made emergencies show that we've come a long way. These responses involve local communities and the state working together to meet the challenges before us. We learn something from every response, and we use those lessons to improve our plans for the future. It is safe to say that we're more ready as a state than we have ever been.

Of course, we don't just respond to crises. Equally important, we take steps to prevent problems from happening in the first place. For example, we've ramped up the public reporting of health care-associated infections and are working with health care providers to prevent such infections. The significant improvement in infection rates has reduced the burden on the health care system and public health across Texas and has helped prevent serious negative outcomes including deaths.

With recent attention on a national measles outbreak, Texas continues its focus on the importance of immunizations and is tracking the issue of vaccine exemptions. Our childhood immunization rates have increased over time, protecting Texas children against measles and other vaccine-preventable diseases. We've also seen a significant reduction in teen smoking rates, helping to stem the leading cause of preventable deaths in the United States. All of these advances have helped improve health in Texas.

DSHS also is making better use of health data, with the development of the 2014 Health Status Report. We're using current data to address today's problems and future needs rather than only reporting a historical account of health issues. Using data to inform public health decision-making is critical to our roles in public health in the future. We must strengthen our efforts to ensure we are using data to drive health interventions and outcomes.

As interim commissioner, my top priority is to navigate the agency through the legislative session while carrying on the work we do to serve Texans every day. A national search is underway for the state's next public health leader. I want to thank Dr. David Lakey for his services as commissioner and for setting a firm foundation for the state's future public health successes. During this time of transition, we look forward to our continued work with our public health colleagues and other local partners to advance the health and well-being of Texans.

Poison Control News

Narcissus: A Potentially Toxic Case of Mistaken Identity

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Narcissus is a genus of spring-flowering, bulbiferous plants in the Amaryllidaceae (amaryllis) family consisting of dozens of species. The genus includes plants commonly known as daffodil, narcissus, and jonquil. *Narcissus* flowers, usually white or yellow, often have six petal-like tepals surmounted by a cup- or tube-shaped structure called a corona. The plants are perennial, dying back after flowering into a long-lived bulb, then regrowing the next year. Native to the Mediterranean, plants of this genus are a popular garden plant.[1]

Narcissus plants contain a variety of alkaloids found not only in the bulb but in other parts of the plant. Toxicity varies by species. Serious adverse effects, and even death, may occur, particularly if large quantities of the plant are eaten. Adverse effects reported with *Narcissus* ingestion include nausea, vomiting, diarrhea, abdominal pain, trembling, convulsions, and paralysis.[2,3] Accidental poisoning may occur when individuals mistake *Narcissus* bulbs or stalks for those of edible plants such as leeks or onions.[2,4] In February 2015, health officials in the United Kingdom asked supermarkets to keep flowers separated from fruits and vegetables because instances had been reported where customers mistook daffodils for edible stems and bulbs.[5] In 2013, 410 exposures classified as *Narcissus pseudonarcissus* were reported to US poison centers.[6]

Texas poison centers received 157 calls about *Narcissus* ingestions during 2000-2014. The ingestions were seasonal, with 68.8% reported during January-April (51.0% in February-March), 10.2% during May-August, and 21.0% during September-December. The patient age distribution was 45.2% 5 years or less, 10.2% 6-12 years, 3.2% 13-19 years, 39.5% 20 years or more, and 1.9% unknown age; 52.2% of the patients were male. Although the exact circumstances of the ingestions were not available, 68.2% were unintentional (general, environmental, therapeutic error), 20.4% unintentional misuse, 3.8%

food poisoning, 5.7% intentional misuse, 1.3% adverse reaction, and 0.6% unspecified intentional. Eighty-five percent of the ingestions occurred at the patient's own residence, 9.6% another residence, 3.8% school, 0.6% public area, and 0.6% unspecified location.

The majority (90.4%) of the patients were managed outside of a healthcare facility, 7.6% were referred to a healthcare facility by the poison center, 1.3% were already at or en route to a healthcare facility when the poison center was contacted, and 0.6% at an unspecified location. Only 5.1% of the ingestions were known or expected to be serious; no deaths were reported. The most commonly reported adverse effects were vomiting (35.7%), nausea (22.3%), diarrhea (5.1%), oral irritation (3.8%), abdominal pain (3.2%), throat irritation (1.9%), and headache (1.9%) - symptoms consistent with those reported in the literature.[2,3] The most frequently reported treatments were dilution (70.1%), food (14.6%), antiemetics (3.2%), and IV fluids (3.2%). These treatments were consistent with those suggested in the literature - treatment of symptoms and gastric decontamination.[2]

These data suggest that *Narcissus* ingestions reported to poison centers are relatively uncommon. They are more likely to occur in the first four months of the year, particularly February and March. Patients will tend to be young children followed by adults, Although ingestion of *Narcissus* has the potential to cause serious adverse effects and even death, most Narcissus ingestions reported to poison centers will not have serious outcomes and may be successfully managed outside of a healthcare facility.

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Pediatric Ingestions of Sodium Phosphate Laxatives

Mathias B. Forrester

Among the available over-the-counter laxatives are products that contain sodium phosphate. These include oral solutions that are taken via the mouth and enemas used rectally. Such products include Fleet brand enemas as well as generic and store-brand products. They may contain only a single active ingredient, either sodium phosphate or sodium biphosphate, or a combination of the two.[1]

The Food and Drug Administration (FDA) reviewed its Adverse Event Reporting System database and medical literature and identified over 50 reports of serious adverse events involving people who took more than the recommended dose of sodium phosphate products.[1] These adverse events involved such problems as severe dehydration and changes in serum electrolyte levels. In a portion of cases, these symptoms were associated with serious kidney and heart problems and even death.[1,2] Those considered most at risk of these adverse effects were young children and adults over 55 years.[1,2]

As a result, on January 8, 2014, the FDA advised that caregivers should not give oral sodium phosphate laxatives to children age five years or less without first consulting a healthcare provider. The FDA also warned that enema versions of the drugs should never be given to children under age two years.[1,2]

During 2000-2014, 1,130 ingestions of sodium phosphate laxatives by children age five years or less were reported to Texas poison centers. There were 462 exposures reported during 2000-2004, 565 during 2005-2009, and 103 during 2010-2014. The rate per 10,000 children age five years or less was 4.7 in urban counties and 6.1 in rural counties. The distribution by child age was 6.6% less than one year, 50.4% one year, 31.8% two years, 7.7% three years, 2.3% four years, 0.7% five years, and 0.4% unknown exact age; 50.9% of the patients were female. Ninety-eight percent of the exposures occurred at the child's own residence and the rest at another residence. All of the exposures were unintentional except for one that was reported to be intentional misuse of the product and one that was an adverse reaction to the product. Other substances in addition to the sodium phosphate laxative were reported in six of the cases.

Ninety-six percent of the children were managed at the residence, 2.8% were already at or en route to a healthcare facility when a poison center was contacted, 0.7% were referred to a healthcare facility by the poison center, and 0.1% were managed at an unspecified location. Ninety-nine percent of the ingestions did not result in serious outcomes, 0.5% in serious outcomes, and in 0.4% the sodium phosphate laxative was considered unrelated to the observed effects. No deaths were reported. Few specific adverse clinical effects were reported; of these, the most common were diarrhea (n=16), vomiting (n=10), and cough or choke (n=3). The most frequently reported treatments were dilution (68.8%) and eating food or a snack (6.7%).

Thus, sodium phosphate laxative ingestions by young children reported to Texas poison centers appear to have declined greatly over recent years. The majority of the children were age one-two years and were evenly distributed by gender. The ingestions were predominantly unintentional and occurred at the child's own home. Such information might be useful for education and prevention strategies. Although there are concerns about giving sodium phosphate laxatives to children five years or less, the majority of sodium phosphate ingestions by such children reported to Texas poison centers were not found to be serious and were managed at home.

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Public Health Practice Commentary

Resistance to Vaccination: The Immunocompromised at Risk

James H. Swan, Ph.D.

Though a small proportion of the population, there are many individuals who are immunocrompromised either as a result of disease or in consequence of treatment for disease, and that number is growing.[1] A major example are those who receive bone-marrow transplants (BMT), from self (autologous) or other donors (allogeneic). In treatment of bone marrow cancer (myeloma), this entails the killing off of existing bone marrow followed by transplant of stem cells previously collected from self or others. The result of such transplants, is that the patient must build a new immune system. There is little chance that the transplanted material carries "memories" of previous immunity.[2] Worse, the rebuilt immune system is less effective at receiving the benefits of subsequent vaccination.[3] Finally, the provision of any vaccination is contraindicated for a period of one to two years, or even longer where there are certain complications. Flu vaccines may be administered after six months; and those for pneumonia, diphtheria, tetanus, pertussis, hepatitis B, H. Influenzae, and polio at one year following transplant. Live vaccines, including those for measles, mumps, and rubella, should not be administered for at least two years following transplant.[1,4-6]

What all of this means is that the immunocompromised are at risk of being infected by various diseases.[7] These include "childhood diseases" to which they had previously acquired immunity, whether by having the diseases or being vaccinated against them. Such childhood diseases can be acquired by adults,[8-9] and can lead to severe complications and even death.[10-11]

That risk is considered low because of one thing: herd immunity.[12] Herd immunity means that enough other people are immune to the diseases that others are unlikely to contract any of them.[12] In the past, adults were largely immune to the "childhood diseases" because they had had them as children; but today herd immunity is largely dependent upon vaccination, as children or later as adults. Some of the diseases are no longer seen as threats in the U.S. because of widespread vaccination – polio comes to mind.

Today, herd immunity in the American public is threatened by those who do not have their children vaccinated.[12] The recent measles outbreak has brought this to the fore. Some do not see it as a serious disease – after all, most children used to get it. But measles is indeed dangerous, outright killing some it strikes and resulting in heart disease in others. And the resurgence of several childhood diseases can be linked to an anti-vaccination movement, interestingly one that is prevalent in affluent, well-educated parents. A long-standing movement,[13] being and anti-vaxxer got a boost in 1998 with the publication of a long-since debunked article claiming a link between some vaccinations and autism. That paper was long-since withdrawn and disavowed by the journal that published it, but it continues to be cited by the anti- vaccination movement.[14] The anti-vaccine movement has been especially facilitated by the Internet.[15] In any case, it is unclear what can effectively address this movement.[16]

There may always be opposition to public health and health measures, but the important, tractable, issue is public policy. School children are required to be vaccinated before entering school; but all states allow the citing of religious or philosophical objections to have the requirement waived.[17] In effect, this generally means that parents who claim any objection whatsoever receive the waiver; and waivers have proliferated in recent years. The result is the lowering of the barrier to disease represented by herd immunity. The allowance in public policy of religious and philosophical objections to vaccination has long been a luxury – so long as herd immunity is high enough, a small minority can be allowed not to vaccinate. As herd immunity declines, however, allowances of such objections becomes a luxury that we can no longer afford. Despite arguments about individual and parental rights,[16] public health must continue to argue about the health of the public and particularly of vulnerable individuals.

So, who is hurt by the loss of herd immunity? Primarily, of course, it is those who remain unvaccinated because of objections, most often the children of parents who voice such objections.[17] This is bad enough not only because of the unnecessary morbidity, and some mortality, suffered among these unvaccinated but also because diseases that can otherwise be eliminated, and in some cases effectively were eliminated, are allowed to persist as dangers to new generations. But in particular, loss of herd immunity entails risk to those who because of age (as with infants) or medical conditions cannot be vaccinated – a category into which I fall. And there are many of us, adults and children alike.

In the case of just one cause, treatment by bone-marrow transplant, there are many at risk. For example, the University of Texas-Southwestern Medical Center in Dallas has a major unit, the Bone Marrow Transplant Unit, dedicated to such treatment. At this one medical center alone, about 100 transplants are performed each year. Altogether, about 18,000 transplants are done in the U.S. each year,[18] 50,000 internationally.[7] Thus, there are many with compromised immune systems due to bone marrow transplant alone, while there are many other causes for being immunocompromised in the population.

In sum, there are many of those at risk of infection from vaccine-preventable diseases cannot receive vaccinations against infectious diseases, at least for long periods of time; and many receive lower levels of protection from such vaccines even when administered. Further, because of compromised immune systems and of the conditions leading to them, infection from such diseases can have particularly dire effects. For the immunocompromised, the major means of protection is reliance on the herd immunity of the population from each such disease. Herd immunity is threatened with increasing proportions of the population who are not vaccinated. Low levels of vaccination stem both from individual reluctance to vaccinate and from the lack of adequate public policies to enhance or mandate such vaccination. Particularly practical and effective are requirements for vaccination as a condition of entering an educational institution, including higher education as well as K-12. Allowance of religious and philosophical objections to mandatory vaccination is a questionable luxury at best; but the lower the rates of vaccination in the population, the costlier this luxury.

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Note: The author is a professor of Applied Gerontology at the University of North Texas and is Immediate Past President of the Texas Public Health Association. He underwent bone-marrow transplant last year.

National Public Health Week: Tribute to Texas Public Health Practice

Compiled by Catherine D. Cooksley, DrPH
Editor, Texas Public Health Journal

About National Public Health Week
First proclaimed by President Bill Clinton, National Public Health Week has been observed during the first full week of April since 1995 "to recognize the contributions of public health and highlight issues that are important to improving the public's health."[1]

The American Public Health Association champions the health of all people and all communities. We strengthen the public health profession. We speak out for public health issues and policies backed by science. We are the only organization that influences federal policy, has a 140-plus year perspective and brings together members from all fields of public health. APHA publishes the *American Journal of Public Health* and *The Nation's Health* newspaper. At our Annual Meeting and Exposition, thousands of people share the latest public health research. We lead public awareness campaigns such as Get Ready and National Public Health Week. Together, we are creating the healthiest nation in one generation.

During the first full week of April each year, APHA brings together communities across the United States to observe National Public Health Week as a time to recognize the contributions of public health and highlight issues that are important to improving our nation. For nearly 20 years, APHA has served as the organizer of NPHW. Every year, the Association develops a national campaign to educate the public, policymakers and practitioners about issues related to each year's theme. APHA creates new NPHW materials each year that can be used during and after NPHW to raise awareness about public health and prevention. [2]

DAILY THEMES

Monday, April 6: **Raising the Grade.** The U.S. trails other countries in life expectancy and other measures of good health, and this holds true across all ages and income levels. Too many people, including some of our political leaders, still believe we have the best health care in the world. We have great doctors, state-of-the-art hospitals and are leaders in advanced procedures and pharmaceuticals - yet our health ranks poorly when compared to other countries. To kick off NPHW 2015, the public health community will come together to talk frankly about what the data reveal about America's public health.

Tuesday, April 7: **Starting from Zip.** Today, your zip code says too much about your health. Within the United States, there are unacceptable disparities in health by race and ethnic group, state by state and even county by county. The effort to make the U.S. the Healthiest Nation in One Generation starts with equity across our communities. During the second day of NPHW 2015, the public health community will shine a light on local/state/regional disparities. We'll come together to discuss the role – and success – of the Affordable Care Act in addressing disparities in access to care, while also laying out what else is needed to achieve health equity across our communities.

Wednesday, April 8: **Building Momentum.** Influential leaders, companies and organizations are taking important steps in line with creating the healthiest nation: just look at recent actions by CVS, America's major food and beverage companies, RWJF, the American Planning Association, Michelle Obama, and many others. On the third day of NPHW 2015, the public health community will outline major recent changes and what they mean for our health. While the outcomes of these changes will play out over many years ahead, these are significant shifts that demonstrate these are significant shifts that demonstrate momentum is building around a higher commitment to our nation's public health.

Thursday, April 9: **Building Broader Connections.** In the work to become the healthiest nation, we can't do it all on our own. We have to expand our partnerships to collaborate with city planners, education officials, public, private and for-profit organizations – everyone who has an impact on our health. During NPHW 2015, the fourth day will focus on communities mapping the network of partners and connections needed in their areas to make the U.S. the Healthiest Nation in One Generation.

Friday, April 10: **Building on 20 Years of Success.** 2015 marks the 20th anniversary of APHA coordinating National Public Health Week, and the accomplishments of the public health community over the last two decades are significant, such as a 25-year improvement in the average lifespan for Americans and a 70 percent reduction in HIV/AIDS-related deaths. During the fifth day of NPHW 2015, the public health community (and especially public health student leaders!) will come together to celebrate these and other accomplishments and bring a renewed focus to the work ahead - and what it will take to become the Healthiest Nation in One Generation.

1. http://pediatrics.about.com/od/healthobservances/p/National-Public-Health-Week-2012.htm . Accessed March 10, 2015
2. http://www.nphw.org/tools-and-tips/themes. Accessed March 10, 2015

Each year, the TPHJ dedicates a section of our journal to celebrate and highlight the efforts of the dedicated public health professionals in Texas. This year, it seemed fitting to incorporate this tribute within our Public Health Practice Commentary section.

In the winter, 2015 issue of the TPHJ we issued a "Call for NPHW Events" and our readers submitted the following activities taking place across Texas. Thank you to all who responded, and thank you for all you do for "everyone, everywhere, every day"! Please go check out the extraordinary public health practice efforts in your community as public health professionals and students strive to "Keep Texans Healthy"!

Galveston, Texas

UTMB Department of Preventive Medicine and Community Practice presents the 2015 Public Health Symposium!
When: Tuesday, April 7, 2015 2:30 PM – 5:30 PM
Poster Session 2:30 to 4:00
Speaker 4:00 – 5:00
Reception 5:00 – 6:00

Where: William C. Levin Hall Dining Room

Galveston County Health District: In observance of National Public Health Week, will be honoring the extraordinary efforts and hard work of seventy (70) food establishments that assure the health and safety of the public that they serve. These well deserving establishments will be awarded a Gold Ribbon during an evening award ceremony and reception. As part of the award ceremony, the Health District will also acknowledge our Outstanding Public Health Heroes who go above and beyond in assisting us to successfully complete our mission and vision for the public's health in Galveston County. The award ceremony is scheduled for April 8th at Wayne Johnson Community Center, Carbide Park, 4102 Main Street, La Marque, Texas 77568. A Meet and Greet Reception will start at 6:00 pm with the awards ceremony following at 6:30 pm. The public is invited. For more information, please call 409-938-2273 or email ExecAsst@gchd.org

Waco-McLennan County Public Health District will provide information to showcase their services/programs in the front lobby, April 6-10, 2015. For more information contact Courtney Restivo Wollard at courtneyr@wacotx.gov.
Monday April 6th, 10am-12pm – Environmental Health providing information on their current services
12-2pm – Immunizations/Outreach providing information on their current programs

Tuesday April 7th: Proclamation by the Waco City Council and McLennan County Commissioner's Court. 10-2pm – WIC providing nutrition education information on building a healthy plate using Dietary Guidelines and ChooseMyPlate.gov.
Wednesday April 8th, 10-12pm – Preparedness/Epidemiology providing information on their current services. 12-2pm – Vital Statistics providing information on their current services.
Thursday April 9th, 10-2pm – Health Education will be providing health screenings – blood pressure, BMI and other health information on their current programs.

Friday April 10th, 10-12pm – HIV/STD will provide rapid testing and gift cards for those who complete the test. 12-2PM – Tuberculosis Clinic providing information on their current services. Saturday April 11th: A finale event will be held in the East Waco community, a neighborhood with known high risk for chronic disease. A Healthy Soul Food Demo and Health Fair will take place at the Doris Miller YMCA Multipurpose Center from 9:00 A.M. to 12:00 P.M. The following screenings will be provided for FREE - blood pressure checks, blood glucose screening, body mass index calculator, HIV screenings and more.

Note: In the most recent community health needs assessment, we documented that chronic diseases are major health concerns in East Waco and may be due to lack of access to physical activity and healthy eating opportunities. In order to learn more about what needs to be done, we need to receive feedback from the community—from the people who live in those neighborhoods and from those who serve them —so that we can work together to develop an effective plan. The Community Assessment for Public Health Emergency Response (CASPER) method door-to-door survey was conducted on March 21st in this East Waco community to gather information on barriers to eating healthy and staying active in their community. CASPER is an epidemiologic tool designed to provide to decision-makers household-based information about an affected community's needs quickly and in a simple format. The information from the surveys will be used to take the first steps to develop resources for promoting physical activity and healthy eating in our underserved neighborhoods. *The editorial team of the TPHJ hopes to provide our readers with more information about this important assessment.*

Austin/Travis County's Health and Human Service Department
For more information contact: Hailey Hale, Planner, Community Health Improvement Planning, Office of the Director Email:Hailey.Hale@austintexas.gov Office (512) 972-5862, Mobile (832) 453-1133Link to Austin / Travis County Community Health Assessment and Improvement Plan. The Austin/Travis County Health and Human Services Department will host a display including tables full of information about public health, our department, and the services we provide in the atrium of City Hall in Austin, Texas. We hope to talk to Council staff and other decision makers and stakeholders to increase the visibility of our department and public health in general. A large banner will be prominently displayed across the front of City Hall for the entire week.

We also plan to host display tables at two Fruit and Vegetable Fairs coordinated by our Women, Infants, and Children program in two high-need areas of Austin. In attendance will be hundreds of families participating in WIC giving us an opportunity to interact directly with them and provide information on available services from our department.

Prior to the week itself, Austin City Council and the Travis County Commissioners Court will both issue proclamations declaring Public Health Week, and we will be featured on two radio interview shows to discuss public health and the services we offer.

Texas Public Health Student group at the University of Texas of Austin is hosting Public Health Week 2015. We invite all of the Greater Austin community to attend our ***Texas Public Health Organizational Fair*** at The University of Texas at Austin Gregory Gym, 2201 Speedway
For more information contact: Kristin Schiele tphpresident@gmail.com

On April 6th from 10am-2pm, Texas Public Health invites all members of the Austin community to come out for our "Kick Off" to Public Health Week 2015. On this day we will be handing out free give aways that promote public health. There will be many health related public health organizations presenting at this event to educate the public about how their organizations are involved in public health and how you can get involved.
On April 7th from 5:30-8:30 PM, we invite all members of the Austin community to come out to our annual Career Fair. Local organizations and companies will come out to recruit those interested in working in public health related careers. It's an event for those in the UT community who are interested in gaining public health experience as well as making a difference in the area.
On April 8th from 6pm-9pm, we will showcase amazing performances representing countries from around the world. Then we will focus on the public health projects going on in each of the seven continents. This night is both entertaining and fun, with food from a wide variety of countries, a silent auction benefitting END7, and quality performances from UT Austin student organizations.
On April 9th from 10am-2pm, Texas Public Health presents its fourth and final day of Public Health Week, Carnival Day! We invite all members of the Austin community to come out and enjoy fun health-focused games, win prizes like yoga baskets and free groceries, and experience the benefits of free health screenings! We will be hosting skin cancer screening tents, HIV screening tents, a blood drive, a mobile mind and body center, and more! It's an event for every Austinite with booths focusing on mental health, physical health, nutritional health, global health, and more! Check out our website @ http://www.texaspublichealth.org/ for more information. See you there!

The Texas Department of State Health Services

Monday April 6, 2015 **Statewide:**
NPHW Proclamations to the Governor (PDF), and to county and local officials.
For more information, contact Monica Hughes at Monica.Hughes@dshs.state.tx.us, call (512) 776-7770, or contact your local or regional health department.

- **University of Texas School of Public Health (texaspublichealth.org)-**details above. Texas Public Health Organizational Fair: 10:00am-2:30pm, UT Austin Gregory Gym
  For more information, contact: Karen Jones at tphvolunteering@gmail.com.
- **Health Service Region 2/3:**
  Physical Activity Poster Contest, "Your Favorite Things To Do Outside". Poster contest for all 4th graders in Health Service Region 2/3. Contest Headquarters is 1301 South Bowen, Suite 200, Arlington, TX 76013.
  For more information, contact Sam Savala at sam.savala@dshs.state.tx.us or call (817) 264-4553.

Tuesday April 7, 2015

- **University of Texas School of Public Health (texaspublichealth.org):**
  Texas Public Health Career Fair: 5:30pm -8:30pm, UT Austin SAC Ballroom
  For more information, contact: Hemangi Patel at tphvpfinance@gmail.com.
- **Sustainable Food Center:**
  East Austin Community Farmer's Market: 3pm - 7pm, 2921 E. 17th St, Bldg. B, Austin, TX 78702
  For more information, contact Joy Casnovosky at joy@sustainablefoodcenter.org, or call (512) 220-1082.
- **Health Service Region 4/5N:**
  Dedication of a new Regional headquarters facility. Dedication will include DSHS leadership from Austin, local elected leadership from the City of Tyler and Smith County, local public health partners and key regional stakeholders in the business and school communities.

For more information, contact Teresa Hubbell at Teresa.Hubbell@dshs.state.tx.us or call (903) 595-3585.

- **Health Service Region 9/10: TB Trainings in El Paso (with The Binational TB Program and Heartland National TB Center of San Antonio):**
  TB Infection Diagnosis and Treatment: 1:00pm – 5:00pm
  For more information, contact Lupe Gonzalez at Lupe.Gonzalez@dshs.state.tx.us.
- **Health Service Region 11 :**
  Drive-Through Vaccine Clinics in Starr, Kleberg, Alice, and Willacy Counties.
  For more information, contact Sylvia Garces-Hobbes at (956) 421-5508.

Wed April 8, 2015

- **DSHS Central Office**:
  DSHS Grand Rounds presentation entitled "The Texas Ebola Experience: Lessons Learned". The presentation will take place from 11:00-12:30 in the DSHS Lecture Hall at 1100 West 49th Street, Austin. Faculty for this presentation will be Wendy Chung. MD, Chief Epidemiologist Dallas County Health Department; Grace Kubin, Ph.D., Director Laboratory Services, DSHS; and Jeff Hoogheem, Deputy Director, Community Preparedness, DSHS.
- **Sustainable Food Center:**
  Triangle Park Community Farmer's Market: 3pm - 7pm, 46th and Lamar at Triangle Park, Austin, TX 78702
  For more information, contact Joy Casnovosky at joy@sustainablefoodcenter.org, or call (512) 220-1082.
- **University of Texas School of Public Health** (texaspublichealth.org)
  Journey Around the World: Global Health Night, University of Texas at Austin Campus. A beautiful showcase of performances from around the world, international health topic discussions, and cultural food vendors.
  For more information, contact Pooja Srikanth at tphexterior@gmail.com.
- **Health Service Region 9/10: TB Trainings in El Paso (with The Binational TB Program and Heartland National TB Center of San Antonio):**
  TB skin test practicum. Three separate 2-hour sessions will be held, in English, Bilingual, and in Spanish. This training will be available to public health providers in Mexico (Ciudad Juarez, Chihuahua) as well as to the Panel Physicians and their clinical staff from the American Consulate in Ciudad Juarez).
  For more information, contact Lupe Gonzalez at Lupe.Gonzalez@dshs.state.tx.us.
- **Health Service Region 11:**
  Girl & Boy Scout Badge Project. Topics include Health Hygiene, Environmental Health, Disaster Preparedness, Zoonosis, and Communicable Disease.
  For more information, contact Sylvia Garces-Hobbes at (956) 421-5508.

Thurs. April 9, 2015

- **The Office of Minority Health**: **Evolution of Minority Health in America**
  Minority Health Month Lunch and Learn 12:00pm – 1:00pm, DSHS Moreton Building Room 653
  To register, or for more information, contact CEDD@hhhsc.state.tx.us.
- **University of Texas School of Public Health (texaspublichealth.org):**
  Texas Public Health Career Fair: 5:30pm -8:30pm, UT Austin SAC Ballroom
  For more information, contact: Hemangi Patel at tphvpfinance@gmail.com.
- **Health Service Region 11:**
  Drive-Through Vaccine Clinics in Starr, Kleberg, Alice, and Willacy Counties.
  For more information, contact Sylvia Garces-Hobbes at (956) 421-5508.

Friday April 10, 2015

- **Health Service Region 11:**
  NPHW 5K, Employee Public Health Hat Day, Dog Walk and Luncheon.
  For more information, contact Sylvia Garces-Hobbes at (956) 421-5508.

Public Health Resources Reviews

Carol A. Galeener, PhD
UT School of Public Health Houston

Book Review: The Lowdown on Legal Highs – Mike Power (2014)
Drugs Unlimited: The Web Revolution That's Changing How the World Gets High

One-quarter of users of club scene drugs would happily ingest any white powder purporting to be a psychoactive, even if its composition and strength were unknown.[1] To prove acceptable to these foolhardy people, mystery drugs would only have to pass the very low bar of being available. Such reckless behavior rivals that of the very best of the Darwin Awards winners, those folks who – almost always posthumously – are recognized for the bad choices that have resulted in removing themselves from any further contributions to the gene pool.[2]

Mike Power's book, Drugs Unlimited, chronicles in minute and at times mind-numbing detail the evolution of the Drugs 2.0 movement which encompasses hallucinogens, stimulants, empathogens and cannabinoids. These drugs are products of a second wave of modern drugs following, although not entirely replacing, older and generally more powerful drugs such as heroin and methamphetamine, and replacing ubiquitous "softer" drugs like cannabis with synthetic substitutes. The claim made in the book is that most of the new wave drugs are not biologically addictive. Nevertheless, the National Institute on Drug Abuse (2015) reports that there is ample evidence that, even a substance as widely used as cannabis can be powerfully addictive in the psychological sense with between one-quarter and half of daily users becoming dependent.[3] In this condition the user can function normally only when the drug is present in the system, and will experience withdrawal symptoms when it is removed.

The "unlimited" appellation applies in two senses. First, Power contends that drug control regimes throughout the world are unable to keep up with emerging new drugs that can be designed as analogues of known drugs through the well-known process of organic chemistry known as "ring substitution." Using these techniques synthetic drugs can be manufactured at a cost of pennies a dose. Most manufacture has been offshored to chemical manufacturers in the Far East. No need for acres of plant material or manufacture under dangerous conditions that might attract the unwanted attention of neighbors or authorities.

As a result of this efficient system new designer drug forms now appear with alarming regularity. The drugs generally escape legal controls, at least when first introduced. They are, in effect, "legal highs." In some instances and some jurisdictions they escape control because their chemical formula is not explicitly prohibited in law or regulation, or in other cases because they have valid uses in industry or as "research chemicals" produced for medical testing psychoactive drugs for treatment purposes. Often distributors skirt even the US Federal Analogue Act law with the simple device of distributing these chemicals under the fig leaf of labels proclaiming "not for human consumption," thus escaping the provisions of the law.

In 2003 mephedrone, a research drug developed in the early twentieth century, was rediscovered as a psychoactive. In its new incarnation it burst on the internet scene to become the first drug then marketed solely through the internet. Mephedrone is an analogue of cathinone, a drug known by its popular name, "bath salts." It became wildly popular and eventually came under control in some jurisdictions, including the USA. But, the genie was out of the bottle. The internet came to be seen as where it all was happening.

This brings us to the second sense of "unlimited:" the business of the sale and distribution of drugs, both legal and illicit. A user planning a "lost weekend" can use to the internet to: research alternative psychoactive substances; view feedback from other users on their experiences while under the influence; find reliable sources by comparing user ratings; and pay through one of several alternative methods, including the digital currency bitcoin. The local postal service or UPS or similar service will show up within days with the package. No danger here – the contents are either legal or are thought to be covered by the "anyone can mail anything to anyone else" defense. In this brave new world the trope of the street corner pharmaceutical salesman seems oddly quaint.

If this were all there were to the story the enterprise would be brought down faster than the hapless user could mutter "NSA." However, information, payment and payment processes have moved to the Dark Net, the highly anonymized and strictly encrypted network that runs like a silent river under the internet using its own routing system named tor, The Onion Router (for the layered security protections upon which it is designed.) For much of the book Power contends that Dark Net is effectively impenetrable.

This contention of invincibility was brought into question in 2013 when FBI agents took down Ross Ulbricht in a San Francisco library accusing him of being the founder and operator of Silk Road, an online drug emporium operating on the Dark Net. Ulbricht was convicted in February 2015 on seven charges of various drug-related offenses and of seeking murder-for-hire. (The latter belies the peace and love hype surrounding psychoactive drug sales.) When arrested, Ulbricht had his hands still on the keys of the laptop he was using. Agents were able to trace his contacts and secure the Silk Road bitcoin wallet. Since then other markets have grown up and flourished on the Dark Net using even more strenuous security measures including things like two-factor authentication. Those who think that the Ulbricht conviction is a pyrrhic victory might consider the more cogent point of the story: ultimately all such activities are vulnerable "IRL" or In Real Life – that is, when they intersect with the real world of fallible people and failing technologies.

Drugs Unlimited is filled with historical background and sotto voce email interviews of major drug middlemen who are known only through pseudonyms. At times Power held himself forth to be a major drug distributor and he lurked in dusky corners of the web observing the postings and the trend of thought. Power's admiration for some of the people who played key roles in this history of drug evolution is barely under the surface of the book. He admits that his perspective is informed by his own experiences with Ecstasy from two decades ago. His holds that adults should be able to consume any substance that they find beneficial. To his thinking, governments are ill-advised, and generally act immorally, in attempting to keep people from doing so.

Power believes that drugs in themselves are not dangerous and that overblown cases of illness and even death are reported by a hysterical press serving its own interests. The relatively few instances of harm are, in this scenario, due to lack of appropriate dosing information and harm reduction mechanisms. In his mind it is those who cast themselves as "psychonauts" in search of the limits of their own minds that are on the leading edge of a movement that is virtually unstoppable. More importantly they are part of a culture that is self-organizing and that has assumed the responsibilities of information dissemination and harm reduction when governments have failed in these respects.

A recent article in The Economist supports this contention albeit with some ambivalence. The author notes that the purity of drugs on offer in the UK has improved remarkably in the past few years, presenting a challenge to users who are familiar with the effects of lower purity but are unprepared for the effects of high purity product when taken in doses far above their active threshold.

The flip side of this coin is that higher purity drugs reduce harm from adulterations that can have very negative and sometimes even lethal effect.[4] The mechanism driving the rapid appearance of higher purity drugs seems to be Adam Smith's "invisible hand" of market forces at work. Various user blogs and sites function as a drug-user Yelp, advising users where they can get "better stuff" from more reliable sources.

The hyperbole in his message aside, Power raises issues that public health can mediate in the broader social dialogue. Should drug users bear the significant burdens of criminalization and stigmatization in what is viewed by most as a "victimless crime?" At the same time there clearly are harms to individuals and to the social fabric that Power does not acknowledge. If it were not so we would not have drug treatment programs and there would not be waiting lists for treatments. These are only the social harms that we can see. What of the loss of social cohesion with such a large community of drug users viewing the world through the distorting lens of their legal highs? This is not a group of people well prepared to function as good citizens, good parents, or generous participants in society. It is a conversation that is worth having now.

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3. National Institute on Drug Abuse (NIDA): "Is marijuana addictive?" http://www.drugabuse.gov/publications/research-reports/marijuana/marijuana-addictive (Retr. from the www 02/10/2015.)
4. Anon. (Feb 9, 2015). "Why some illicit drugs are getting purer." *The Economist*, online edition.

Software Review: Getting a Handle on Drug Relapse: the MAP Approach

Editorial Note: TPHA was approached regarding a software package to track relapse after rehabilitation. TPHA members, Carol Galeener and Abimbola Farinde volunteered to view a demonstration of the software and Dr. Galeener reports on their observations.

We are not winning the war on drugs. The book *Drugs Unlimited*, reviewed nearby, suggests that we never will and that the aim of society should be harm reduction rather than drug proscription. Many of those who advocate for a legal status for the "usual suspects" -- cannabis and the horde of psychoactive drugs on offer -- suggest that there is no evidence of long-lasting harm from these "benign" substances. This position is at odds with evidence demonstrating that early and continuing use of marijuana from teenage years is associated with significant cognitive impairment, academic underachievement, and psychotic episodes after heavy usage.[1,2] Others have raised the white flag and taken the stance that the game of prosecution and incarceration is simply not worth the candle. Tacitly agreeing with one or both of these positions, twenty-three states and the District of Columbia now have laws legalizing marijuana in some form.[3]

In the meantime, addiction and dependency programs are busy treating the "usual addicts," the young and the reckless, as well as a growing contingent of not-so-usual addicts, boomers who partied in the 60's and 70's and have taken up drugs once again in late middle age.[4] A quick excursion through the National Institute on Drug Abuse's Monitoring the Future Study reveals depressing statistics at the lower end of the age spectrum: one fifth of twelfth graders have used marijuana in the past month; more than 37 per cent have used alcohol, many as binge drinkers.[5] Some substantial fraction of these will continue use and become dependent or addicted, eventually requiring treatment. Slightly more than half of all those treated in drug programs funded by the Texas Department of State Health Services are treated for marijuana/ hashish or alcohol abuse that often starts in these formative years.[6] At the upper end of the age spectrum, more than 12,000 people aged 45 – 64 died of drug overdoses in the U.S. in 2013, a startling 11-fold increase in rate since 1990 for this age group.[4]

A potential bright spot on the treatment front is the approach taken by Austin-based MAP Health Management. MAP Health Management provides a variety of services to institutions operating drug treatment programs. Among those services is patient recovery support. MAP representatives recently demonstrated the software that peer counselors use to manage contacts with a discharged patient and his or her permitted contacts for a period of up to a year after discharge. Through this proactive contact process a counselor can identify when it is appropriate to refer a patient back to treatment – hopefully before a downward spiraling relapse event.

Over time this type of constant contact of patient and permitted contacts doubtless helps build counselor intuition about the conditions leading to impending relapse. Nevertheless, there are limits to the value of intuitive expertise. Paul Meehl[7] and others have explored these limits with regard to clinical judgment, identifying the general superiority of algorithmic processing to the typical judgment patterns of clinicians. The Nobel laureate Daniel Kahneman summarized the conditions under which intuition works best: immediacy of feedback; and what he terms "stable regularities in the environment."[8] Both can be somewhat problematic conditions in the difficult world of the recovering addict.

Progressing toward an algorithmic response requires data – and that is exactly what MAP captures in prodigious amounts, recording the encounter experiences, variables and outcomes of each discharged patient over an extended period. The MAP analyst team exploits these data through survival analysis, a mathematical approach commonly employed in analyzing problems public health data, to determine the conditions under which the average recovering addict is likely to relapse into drug usage. While it is still early, this approach represents an intriguing forward step in improving the prospects of putting a block in the revolving treatment door that is all too often the case.

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Wind Ensemble Infectious Disease Risks: A Microbiological Examination of Water Key Liquids in Brass Instruments

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ABSTRACT
Objective: To determine whether the fluids that wind instrument players release onto rehearsal hall floors pose a risk to band members or others using the rehearsal area.
Methods: Thirty samples were obtained from five types of brass instruments (trumpet, French horn, trombone, baritone, tuba). These were processed as environmental cultures.
Results: Twenty-three samples grew Alcaligenes faecalis. Three trumpet specimens, one French horn specimen, and one trombone specimen grew oral flora from their samples. One sample grew a species which is generally considered to be a fecal contaminant.
Conclusions: Most large brass instruments (trombone, euphonium, and tuba) do not contain oral bacteria. French horns and trumpets may have oral bacterial flora in their accumulated liquid. Most instruments will have Alcaligenes faecalis. In general the liquid from water keys does not pose an environmental hazard to persons with normal immune systems. Bands are highly inclusive and diversified. There may be special situations in which players are prone to infection or have cancer or immune disorders, which would require attention for the prevention of infections.
Key Words: band, water key, spit valve, Alcaligenes

INTRODUCTION

Every day thousands of brass instrument players empty their water keys (also known as 'spit valves') after playing their instruments. This liquid may be released on a used newspaper, a cloth, the rug, or the floor. Little thought is given to whether the liquid released may potentially harbor pathogenic organisms even though there is a 'Spit Valve Etiquette' among some brass players.[1,2] Although no instances of disease outbreaks among high school bands have been recorded by the Texas Department of State Health Services or the Centers for Disease Control and Prevention,[3,4] there remains a possibility of disease transmission. If the fluid released from a water key has a significant component of oral bacterial flora, then there is a possibility of an infectious disease outbreak. If the fluid released from a water key is predominantly sterile condensed vapor, there would be less concern over managing these fluid releases. Football and other sports teams have experienced infectious diseases including viral meningitis and Methicillin-resistant Staphylococcus aureus (MRSA).[5,6] Schools have also experienced outbreaks of Norovirus causing vomiting and diarrhea.[7]

LITERATURE REVIEW

No articles were found that addressed the microbiology of water key discharges.

In 1956, Bryan introduced the concept of players with reduced resistance to infection being more vulnerable to musical instruments causing disease. He also discussed the possibility that a contaminated instrument could reintroduce infection in the same individual.[8] He demonstrated the presence of oral bacterial flora on both mouthpieces and reeds.

In 1959, Walter and Chaffey published a study of bacterial growth in mouthpieces. They refer to reports of "such accumulations in the shank of the mouthpiece that tones have been impaired and blowing has been difficult."[9] The authors speculate that silver might retard bacterial growth on mouthpieces.

Woolnough-King surveyed woodwind and brass instruments in 1994-1995. He refers to a 1957 outbreak of tuberculosis in a British military band. He found Streptococcus and Staphylococcus species in the instruments. He opined, "high infective doses of these pathogens, caused by growth inside the mouthpieces, may explain why musicians suffer frequently from throat infections."[10]

In 2001, Ahlèn reported the case of a fifteen-year-old Norwegian baritone player who developed recurrent pneumonia. The recurrences coincided with episodes of playing the baritone. She improved clinically when she travelled to the United States and did not play her horn. When she returned to Norway and began playing, the pneumonia returned. Sputum cultures grew Chryseobacterium meningosepticus. Chryseobacterium was also obtained from the horn. The author states that the "microbiological survey presented strongly points to a connection between the patient's baritone horn playing and her multiple bouts of pneumonia."[11]

Bridges has previously examined bacterial flora in the lead pipes of brass instruments.[12] She found mostly non-pathogenic oral flora; however, potentially pathogenic Bacillus, Staphylococcus, Streptococcus, and Pseudomonas species were identified.

In 2010, the Fauquier Ear Nose & Throat Consultants of Virginia discussed musical instruments and infection in their blog. They describe the "well known medical principle being bacteria grows in dark wet areas." They recommend not sharing instruments, drying the instrument after use, not playing an instrument while sick, cleaning the mouthpiece daily, and washing brass instruments in the bathtub.[13]

Glass, et al conducted a study of the bacterial flora of band instruments in 2010. They identified 295 bacterial isolates. Also 16 yeast isolates and 61 mold isolates were obtained. The authors describe the isolates as being "opportunistic, pathogenic, and/or allergenic." More isolates were obtained from the mouthpiece and fewer were obtained toward the bell. The authors state that the band teacher "confirmed that at any given time, more than 50% of her band students had some respiratory issues (asthma, bronchitis) that required therapy."[14]

WBZ Television (Boston CBS) reporter Joe Shortsleeve reported on a proposed law to require sterilization of musical instruments. He reported that the Centers for Disease Control and Prevention had no record of diseases being transmitted through musical instruments. He questioned the motives of the bill's supporters to force schools to use an expensive instrument sterilization service.[4]

OBJECTIVE

To determine if fluid released from water keys contains oral bacterial flora and therefore represents a potential health threat.

DESIGN, SETTING, AND PARTICIPANTS

Study design was a descriptive ecologic study. Instruments cultured were brass instruments from the Del Mar College Wind Ensemble and the Veterans Band of Corpus Christi. The Del Mar College Wind Ensemble is comprised of college students, most of whom are aged 18-24 years in age. The Veterans Band of Corpus Christi is made up exclusively of military veterans, most of whom are aged 65-90 years in age. Samples were obtained from the water keys (or slides) of five types of brass instruments: trumpets, trombones, baritones/euphoniums, tubas, and French horns. The results were analyzed by type of instrument.

MATERIALS AND METHODS

The musicians were informed of the purpose and design of the study. Since this was a descriptive study with no intervention, there was no risk to the instruments or the musicians from the study. The identity of the instrument owners was blinded to protect anonymity. Swabs were taken from the water keys of brass instruments in the Del Mar College Wind Ensemble and the Veterans Band of Corpus Christi. French horn players had the option of emptying a slide or using a water key if they had one. (Most French horns do not have a water key. A tuning slide is removed to dump the accumulated liquid.) The swabs were processed as environmental specimens by Clinical Pathology Laboratories, Austin, Texas. Since there was no intervention and instruments were tested anonymously, Institutional Review Board approval was not requested.

A total of 30 specimens were processed. Since twenty-three of thirty samples grew a similar morphology (Oxidase Positive, Gram Negative Rod), one of these specimens was further processed to identify the species of rod. Culture results were obtained and categorized by instrument.

RESULTS

Twenty-six samples were obtained from the Del Mar College Wind Ensemble and four samples were obtained from the Veterans Band. Twenty-three samples grew Alcaligenes faecalis. Three samples grew two species. Bacilli were identified in 27 samples (77%), cocci in six (17%) and no growth in two samples (6%). Two instrument groups (euphonium and tuba) grew only Alcaligenes faecalis. All five instrument groups grew Alcaligenes faecalis in at least some of their specimens. Three trumpet specimens, one French horn specimen, and one trombone specimen grew oral flora from their samples. One sample grew a species which is generally considered to be a fecal contaminant (Citrobacter).

Table 1. Instruments

INSTRUMENT	NUMBER	PERCENT
Euphonium	4	13
French Horn	4	13
Trombone	7	23
Trumpet	12	40
Tuba	3	10
TOTAL	30	

Table 2. Species by Instrument

INSTRUMENT	BACTERIA	NUMBER
Euphonium (4)	Alcaligenes faecalis	4
French Horn (4)	Alcaligenes faecalis	2
	Bacillus not B. anthracis	1
	Staphylococcus aureus	1
	No growth	1
Trombone (7)	Alcaligenes faecalis	6
	Streptococcus viridans	1
Trumpet (12)	Alcaligenes faecalis	7
	Gram negative Bacillus	1
	Citrobacter koseri	1
	Gram positive bacillus	1
	Alpha streptococcus	1
	Streptococcus viridans	1
	No growth	1
Tuba (3)	Alcaligenes faecalis	3
Total (30)		32

* One specimen (French Horn) grew Staphylococcus aureus and Bacillus not B. anthracis

Two specimens (Trumpet and Trombone) group A. faecalis and S. viridans.

Table 3. Bacterial Types

BACTERIA	NUMBER	PERCENT
Alcaligenes faecalis	23	70
Alpha Streptococcus	1	3
Bacillus not B. anthracis	2	6
Citrobacter koseri	1	3
Gram negative bacillus	1	3
No growth	2	6
Staphylococcus aureus	1	3
Streptococcus viridans	2	6
Total	33	

Table 4. Bacterial Morphology

BACTERIA	NUMBER	PERCENT
Bacillus	27	82
Coccus	6	18
Total	33	

Table 5. Gram Stain Distribution

BACTERIA	NUMBER	PERCENT
Gram Stain Positive	27	77
Gram Stain Negative	6	17
No growth	2	6
Total	35	

DISCUSSION

Alcaligenes faecalis, found in twenty-three of the thirty samples, is an environmental microbe which exists in soil and water.[15] It is frequently recovered from high moisture environments in hospitals. Although it is not usually a pathogen, it has been associated with eye infections, cystic fibrosis patients, and severely ill hospital patients.[16]

Most large brass instruments (trombone, euphonium, and tuba) did not contain oral bacteria in this sample of water key liquids. One trombone grew an oral bacterium (Streptococcus viridans). French horns and trumpets show more variability in their bacterial flora, possibly because of the shorter distance between the mouthpiece and the trumpet water key or the French horn slide.

This is a small data set that provides at best a glimpse of the bacterial milieu of wind instruments. Reed instruments have a different composition and design and should also be cultured. In general the liquid from the water keys of brass instruments does not pose an environmental hazard to persons with normal immune systems.

RECOMMENDATIONS

Bands are exceptional as student activities in that they are highly inclusive and diversified. Often, students with mental, physical, or emotional conditions that prevent participation in athletics or other activities can participate in and be enriched by band music. While most band students are healthy and unlikely to be put at risk by band activities, there may be special situations in which players are prone to infection or have cancer or immune disorders, which would require attention for the spread of infections. Although this study was designed primarily for students, community bands and musical organizations with older participants, especially the elderly, might be more vulnerable to the spread of infection.

Many band directors have felt that their students have a higher than usual incidence of upper respiratory infections, but no ecological studies comparing musicians with age match cohorts have been done to demonstrate this risk factor.[10,14] Although the Centers for Disease Control and Prevention and the Texas Department of State Health Services have no record of disease outbreaks in bands, bands are vulnerable during travel when they share food and close spaces. A contagious disease outbreak could reduce a band to ineffectiveness. Band directors should be alert for unusual patterns of disease or infection in band members. Good health practices should be a regular part of musical instruction. Good health practice should include cleaning institution-owned instruments before reissuing them to another student.

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Rural-Urban Differences in Late-Stage Breast Cancer: Do Associations Differ by Rural-Urban Classification System?

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ABSTRACT

Introduction

Rural residence is associated with later stage of breast cancer diagnosis in some but not all prior studies. The lack of a standardized definition of rural residence may contribute to these mixed findings. We characterize and compare multiple definitions of rural vs. non-rural residence to provide guidance regarding choice of measures and to further elucidate rural disparities in breast cancer stage at diagnosis.

Methods

We used Texas Cancer Registry data of 120,738 female breast cancer patients ≥50 years old diagnosed between 1995-2009. We defined rural vs. non-rural residence using 7 different measures and examined their agreement using Kappa statistics. Measures were defined at various geographic levels: county, ZIP code, census tract, and census block group. Late-stage was defined as regional or distant disease. For each measure, we tested the association of rural residence and late-stage cancer with unadjusted and adjusted logistic regression. Covariates included: age; patient race/ethnicity; diagnosis year; census block group-level mammography capacity; and census tract-level percent poverty, percent Hispanic, and percent Black.

Results

We found moderate to high levels of agreement between measures of rural vs. non-rural residence. For 72.9% of all patients, all 7 definitions agreed as to rural vs. non-rural residence. Overall, 6 of 7 definitions demonstrated an adverse association between rural residence and late-stage disease in unadjusted and adjusted models (Adjusted OR Range = 1.09-1.14).

Discussion

Our results document a clear rural disadvantage in late-stage breast cancer. We contribute to the heterogeneous literature by comparing varied measures of rural residence. We recommend use of the census tract-level Rural Urban Commuting Area Codes in future cancer outcomes research where small area data are available.

KEY WORDS

breast cancer, rural, health disparities, measurement, cancer stage

INTRODUCTION

Among U.S. women, breast cancer is the leading cause of cancer and the second leading cause of cancer deaths[1]. Stage at diagnosis is the most significant prognostic factor for survival. Five-year relative survival is 98% for localized disease but falls to only 24% for distant disease[1].

Living in a rural area has been associated with later stage of breast cancer diagnosis in some but not all prior studies[2,3]. It is not known whether the mixed findings to date result from varying definitions of urban vs. rural or from other aspects of study design (e.g. different populations, covariates, or model specifications). A recent literature review examining rural residence and cancer outcomes found wide heterogeneity in the use of definitions of rural vs. non-rural residence and describes the literature as "nascent and methodologically inconsistent." (p. 1657)[2]. Another recent study compared breast cancer stage at diagnosis between women living in urban vs. rural areas. This systematic review and meta-analysis of 21 studies, despite documenting mixed findings in the extant literature, concluded that patients living in rural areas were more likely to be diagnosed with late-stage breast cancer[3]. This review also noted wide variation in definitions of "rural,"[3] as have previous reviews[4].

In the cancer literature, researchers typically rely upon methods developed by government agencies for defining "rural" residence[2]. These methods are relatively simple to calculate and use publicly available data. But to date, there are no methodologic studies available that compare and contrast available methods. Our study aims to fill these gaps in the literature. In this study, we characterize and compare multiple definitions of rural vs. non-rural residence in a study of breast cancer patients in Texas to 1) provide guidance to cancer outcomes researchers regarding choice of measures and to 2) further elucidate rural-urban disparities in breast cancer stage at diagnosis.

METHODS

Data and Sample

Data were obtained from the Texas Cancer Registry (TCR), a North American Association of Central Cancer Registries (NAACCR) gold-certified population-based cancer registry. Female adult (≥50 years old) breast cancer patients diagnosed between 1995-2009 were eligible for inclusion. Data were limited to women aged 50 and older because breast cancer screening, a primary determinant of late-stage cancer diagnosis, is recommended for women aged 50 years and older by the U.S. Preventive Services Task Force[5]. Data were limited to patients with a first primary breast cancer and patients with known cancer stage. Data were geocoded by TCR. To ensure accuracy, we limited inclusion to patients with addresses geocoded at the street address level, representing the highest degree of geocoding certainty. Using latitude and longitude of patient residence at diagnosis, we spatially joined the patients in the sample to their respective counties, ZIP codes, census tracts, and block groups. Then, we merged in 2000 U.S. Census data as provided by Geolytics Inc. (Census 2000, Long Form [SF3], GeoLytics, Inc., East Brunswick, NJ, 2012.) including population values at the county, ZIP code, census tract, and block group levels. We obtained data on location and number of mammography machines in the year 2000 obtained from a Freedom of Information Act request to the Food and Drug Administration (requested July 2008, received March 2009). This study was approved by UT Southwestern Medical Center, Texas Cancer Registry, and the Texas Department of Health and Social Services Institutional Review Boards.

Urban-Rural Classification Methods

We compared seven different urban/rural measures, defined at block group, census tract, ZIP code, and county levels. Attributes of each measure are provided in Table 1 and described briefly below. All

measures were developed by governmental agencies based on one of multiple taxonomies. The underlying taxonomies incorporate factors such as population size, density, urbanization, and commuting patterns. Measures were downloaded from governmental agency websites (see references in Table 1) in pre-specified formats. Therefore, as succinctly described in a recent review[2], many of these measures were developed by transforming underlying, granular block-level classifications (the smallest geospatial unit in Census data) to larger units. Thus, for example, an urban census tract may actually include some rural blocks. Some degree of this problem, known as overbounding or underbounding is inherent to any definition of rurality[6]. All measures except the block group measure were already classified at their representative geospatial unit (e.g. census tract). We classified block groups using the location of the block group centroid. Thus, for example, all block groups with a centroid within an urbanized area (according to U.S. Census classification, UA/UC shapefile) were considered as such. Also of note, ZIP Code configurations change frequently, do not represent Census area spatial boundaries, and do not necessarily represent polygons[7-9]. Thus, to convert ZIP codes to spatial units, both ZIP code measures (FAR and zip-RUCA) applied different source mapping data and methods, as described elsewhere[10,11]. Comprehensive reviews of the intricacies of measurement (e.g. definitions underlying each method, the difference between non-metropolitan vs. rural) are available elsewhere[2,6,12-14].
For each measure, we applied multiple categorizations of urban-rural residence identified from measure documentation[10,11,15-20] and previous literature[21]. Table 1 denotes the binary (rural vs. non-rural) categorization for each measure and any alternative categorizations (e.g. large metropolitan, small metropolitan). Alternative categorizations are further described in Appendix 1.

Outcome and Covariates

The outcome was late-stage cancer defined using the Surveillance Epidemiology and End Result (SEER) summary stage variable as: late (regional or distant) vs. early (in situ or localized).

We included several covariates in our adjusted models in order to control for confounding factors found to be associated with urban/rural residence and/or stage at diagnosis in previous studies[3,22,23]. Patient-level covariates included: race (non-Hispanic white, non-Hispanic black, Hispanic, other, and unknown); age (50-59, 60-69, 70-79, ≥80); and diagnosis year (1995-97, 1998-00, 2001-03, 2004-06, 2007-09). Neighborhood-level covariates included: census tract-level percent poverty, percent black, and percent Hispanic; and block group-level mammography capacity.

We measured mammography capacity using the two-step floating catchment area (2SFCA) method as first described by Luo et al.[24] and later applied to mammography by Eberth et al.[25] In essence, this measure accounts for both the supply (i.e., number of available mammography machines) and demand (i.e., number of women ≥ 50 years based on 2000 U.S. census data) for mammography services at the block group level. Step 1 of the 2SFCA is a facility specific machine-to-population ratio and step 2 is a block group specific ratio that sums over all the facilities that fall within 60 minutes from the population-weighted block group centroid. The resulting spatial accessibility score is then categorized into 3 levels of capacity (poor, adequate, and excess) based on the expected number of machines needed to meet the biennial screening goal of 81% set by Healthy-People 2020[26].

Analysis

We first describe characteristics of breast cancer patients in our sample. We compared the distribution of covariates by rural vs. non-rural residence using the county-based definitions using chi-square and t-test statistics. We describe covariates using the county-based definitions rather than comparing covariates across all 7 measures to simplify our presentation of data.

We next compared the 7 measures of rural residence. Using descriptive statistics and maps, we examined the classification of Texas geographies and total population defined as rural or non-rural using each measure. We generated four maps, one each for: county-level measures (n=3), ZIP-code measures (n=2), and census tract (n=1) and block group (n=1) measures. For each urban/rural measure, we compared the distribution of late vs. early stage cancers by rural vs. non-rural residence using chi-square statistics.

Among breast cancer cases, we assessed agreement between each binary urban/rural measure using percent agreement, kappa, and prevalence- and bias-adjusted kappa (PABAK). Kappa adjusts for the amount of agreement expected to occur by chance alone[27]. To correct for the tendency of kappa to be highly dependent on the prevalence of the condition in the population, we also report PABAK 28. PABAK assumes fifty percent prevalence of the condition and absence of any bias, thereby reflecting an ideal situation and ignoring the prevalence and bias present in the "real world". We judge the adequacy of kappa and PABAK following guidelines suggested by Landis and Koch: poor: 0-0.20; fair: 0.21-0.40; moderate: 0.41-0.60; substantial: 0.61-0.80; and nearly perfect agreement: 0.81 to 1.0 29.
Finally, to measure the association of rural residence and late-stage disease, we fitted a series of unadjusted and adjusted logistic regression models. Adjusted models controlled for all covariates described above. We fitted binary measures of rural vs. non-rural residence and categorical measures as described in Table 1. For the categorical analyses of each measure we set the most urban category as the referent. In sensitivity analyses, to adjust for the non-independence of observations within each "level" (e.g. census tract, county), we added random intercepts to each model defined at the block group, census tract, ZIP code, and county-level, as appropriate. For example, for the ZIP-code FAR measure, models included a random intercept at the ZIP code level. All analyses were conducted in STATA Version 13.0 (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP). Maps were created in ArcGIS Version 10.1 (ESRI 2011. ArcGIS Desktop: Release 10.1 Redlands, CA: Environmental Systems Research Institute).

RESULTS

In all, there were 120,738 breast cancer patients included in this study. Comparison of patients by rural vs. non-rural residence (as defined by county-based methods of UI, NCHS, and RUCC) are provided in Table 2. Distribution of all covariates differed significantly between rural and non-rural patients. Notably, rural patients were more likely to be white, live in areas of poor mammography capacity and resided in neighborhoods where a greater percent of the population lived in poverty. In additional analyses [not shown], we compared covariates across all 7 measures and the results of this analysis were comparable.

We examined the classification of Texas geographies and total population of Texas using each of the 7 rural vs. non-rural definitions (Appendix 2). For all definitions, a greater percent of total area in miles was considered rural (ranging from 53.5-97.3%, depending on definition). However a greater percent of the population lived in non-rural areas (ranging from 81.6-94.5% in non-rural and 5.5-18.4% in rural areas depending on definition).

Of all breast cancer patients, 88% (n=106,706) were diagnosed with early stage disease whereas 11.6% (n=14,032) were diagnosed with late disease (Appendix 2). The number of patients defined as resid-

Table 1. Characteristics of Seven Classification Methods of Urban/Rural Status

Urban/Rural measures by geographic unit and measure source documentation	Urban/ Rural categorizations	How characterized and (number of categories)
County		
UI: Urban Influence Code[16]	**1. Binary** Non-rural: 1-2 Rural: 3-12 **2. Four categories:** 1 (1) [most urban], 2 (2), 3 (3-5), 4 (6-12) [most rural]	Population size, proximity (measured with adjacency and percentage of persons commuting) to metropolitan areas (12)
NCHS: National Center for Health Statistics Urban-Rural Classification Scheme[15,19]	**1. Binary** Non-rural: 1-4 Rural: 5-6 **2. Six categories:** 1 (most urban) - 6 (most rural)	Population size, proximity to metropolitan areas (6)
RUCC: Rural Urban Continuum Code[17], also known as Beale's codes	**1. Binary** Non-rural: 1-3 Rural: 4-9 **2. Five categories:** 1([most urban]; 1); 2(2); 3(3); 4(4-7); 5([most rural]; 8-9)	Population size, proximity to an urbanized area and adjacency to metropolitan areas (9)
ZIP Code		
FAR: Frontier and Remote Area Code[10]	**1. Binary** Non-rural: No FAR Indicators Rural: Any of 4 FAR Indicators **2. Five categories:** 0 (most urban/no FAR indicators); 1; 2; 3; 4 (most rural/remote)	Degree of geographic remoteness characterized by population size and car travel time to nearby urban areas (5[a])
zRUCA: ZIP-Code Rural Urban Commuting Area[11]	**1. Binary** Non-rural: 1, 1.1, 2, 2.1, 3, 4.1, 5.1, 7.1, 8.1, 10.1 Rural: (4.0, 4.2, 5.0, 5.2, 6.0, 6.1, 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2, 10.0, 10.2, 10.3, 10.4, 10.5, 10.6) **2. Four categories:** 1 ([most urban];1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, 10.1); 2 (4.0, 4.2, 5.0, 5.2, 6.0, 6.1); 3 (7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2); 4 ([most rural];10.0, 10.2, 10.3, 10.4, 10.5, 10.6) **3. Three categories:** 1 ([most urban]; 1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, 10.1); 2 (4.0, 4.2, 5.0, 5.2, 6.0, 6.1); 3 ([most rural]; 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2, 10.0, 10.2, 10.3, 10.4, 10.5, 10.6)	Population density, proximity to an Urban Area, daily commuting patterns (33)
Census Tract		
tRUCA: Tract Rural Urban Commuting Area[18]	Same as z-RUCA, above	Population density, urbanization, daily commuting patterns (33)
Block Group		
UA/UC: Urbanized Area/Urban Cluster[49]	**1. Binary** Non-rural: Urbanized Area or Urban Cluster Rural: Neither Urbanized Area or Cluster **2. Three categories:** 1 ([most urban]; Urbanized Area); 2 (Urban Cluster); 3 ([most rural]; Rural/Neither Cluster nor Area)	Population density (3)

[a]The 5 FAR categories are comprised of the 4 FAR indicators as well as the lack of an indicator (non-rural ZIP codes)

Table 2. Sample Characteristics of Breast Cancer Patients by Rural or non-Rural[a] Residence (n=120,738)

	Non-rural (n=106,706)	Rural[a] (n=14,032)	p
	N (%)	N (%)	(chi^2)
Diagnosis Year			
1995-1997	16,567 (15.5)	2,158 (15.4)	.001
1998-2000	20,233 (19.0)	2,704 (19.3)	
2001-2003	22,090 (20.7)	2,999 (21.4)	
2004-2006	22,585 (21.2)	3,064 (21.8)	
2007-2009	25,231 (23.7)	3,107 (22.1)	
Age			
50-59	38,402 (36.0)	3,699 (26.4)	<.001
60-69	32,212 (30.2)	4,342 (30.9)	
70-79	24,404 (22.9)	3,850 (27.4)	
≥80	11,688 (11.0)	2,141 (15.3)	
Race/ethnicity			
White	77,625 (72.8)	11,412 (81.3)	<.001
Black	10,883 (10.2)	918 (6.5)	
Hispanic	15,490 (14.5)	1,622 (11.6)	
Other	2,188 (2.1)	56 (0.4)	
Unknown	520 (0.5)	24 (0.2)	
Neighborhood poverty			
<10%	57,489 (53.9)	1,994 (14.2)	<.001
10-19.9%	27,789 (26.0)	8,019 (57.2)	
≥20%	21,428 (20.1)	4,019 (28.6)	
Mammography capacity			
Poor	8,766 (8.2)	5,179 (36.9)	<.001
Adequate	584 (0.6)	2,374 (16.9)	
Excess capacity	97,356 (91.2)	6,479 (46.2)	
	Mean (SD)	Mean (SD)	(t-test)
Neighborhood Composition			
Perblack	11.7 (19.2)	8.7 (11.7)	<.001
Perhispanic	26.5 (25.6)	23.1 (23.2)	<.001

[a]Rural vs. non-rural residence defined using County-based methods (UI, NCHS, RUCC)

Table 3. Percent Agreement, Kappa, and Prevalence- and Bias-Adjusted Kappa (PABAK) between Seven Binary Urban-Rural Measures defined at the County, ZIP Code, Census Tract, and Block Group Levels

Comparisons by Geography and Measure	% Agreement	Kappa	PABAK
County-County			
UI-RUCC	100		
UI-NCHS	100		
RUCC-NCHS	100		
County-ZIP			
County-FAR	92.2	46.3	84.3
County-zRUCA	95.7	81.1	91.6
County-Tract			
County-tRUCA	91.9	66.7	83.8
County-Block Group			
County-BG	81.8	19.1	63.6
ZIP-ZIP			
FAR-zRUCA	89.4	38.3	78.8
ZIP-Tract			
FAR-tRUCA	86.9	31.7	73.8
zRUCA-tRUCA	93.0	73.1	85.9
ZIP-Block Group			
FAR-BG	83.5	8.7	66.9
zRUCA- BG	80.5	23.3	61.0
Tract-Block Group			
tRUCA- BG	78.2	19.0	56.4
All 7 Definitions agree	72.9	54.3	-

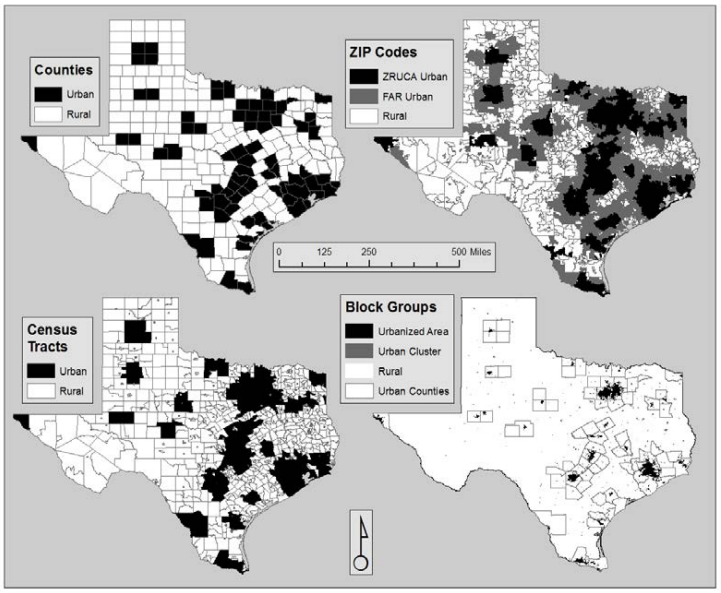
Note: all Kappa and PABAK values are p<.0001

Table 4. Unadjusted and adjusted association of urban/rural status and late-stage breast cancer across 7 classification methods (n=120,738)

	Crude Odds Ratio (OR) and 95% CI			**Adjusted Odds Ratio (aOR) and 95% CI**		
	Method 1 (Binary Rural vs. non-rural)	Method 2	Method 3	Method 1 (Binary Rural vs. non-rural)	Method 2	Method 3
County						
UI 1 (most urban)	1	1	-	1	1	-
2	**1.21 (1.14-1.28)**	**1.14 (1.09-1.19)**	-	**1.14 (1.06-1.22)**	**1.06 (1.01-1.12)**	-
3	-	**1.23 (1.14-1.33)**	-	-	**1.17 (1.06-1.28)**	-
4 (most rural)	-	**1.28 (1.18-1.39)*** **	-	-	**1.17 (1.07-1.27)*** **	-
RUCC 1 (most urban)	1	1	-	1	1	-
2	**1.21 (1.14-1.28)**	**1.27 (1.19-1.35)**	-	**1.14 (1.06-1.22)**	**1.11 (1.03-1.18)**	-
3	-	1.03 (0.97-1.10)	-	-	1.03 (0.96-1.10)	-
4	-	**1.25 (1.18-1.33)**	-	-	**1.16 (1.08-1.25)**	-
5 (most rural)	-	**1.35 (1.05-1.72)***	-	-	**1.31 (1.02-1.68)***	-
NCHS 1 (most urban)	1	1		1	1	
2	**1.21 (1.14-1.28)**	**0.94 (0.89-1.00)**	-	**1.14 (1.06-1.22)**	1.06 (0.99-1.13)	-
3	-	**1.23 (1.15-1.31)**	-	-	**1.13 (1.05-1.20)**	-
4	-	1.01 (0.94-1.08)	-	-	1.04 (0.97-1.11)	-
5	-	**1.28 (1.18-1.38)**	-	-	**1.24 (1.13-1.36)**	-
6 (most rural)	-	**1.18 (1.08-1.29)*** **	-	-	**1.15 (1.04-1.27)*** **	-
ZIP-Code						
z-RUCA 1 (most urban)	1	1	1	1	1	1
2	**1.19 (1.12-1.25)**	**1.21 (1.13-1.30)**	**1.21 (1.13-1.30)**	**1.12 (1.05-1.20)**	**1.15 (1.07-1.24)**	**1.15 (1.07-1.24)**
3	-	**1.16 (1.05-1.27)**	**1.15 (1.06-1.24)*** **	-	1.07 (0.96-1.18)	1.08 (0.99-1.18)
4 (most rural)	-	1.13 (0.98-1.30)	-	-	1.10 (0.95-1.30)	
FAR 1 (most urban)	1	1	-	1	1	-
2	**1.28 (1.17-1.41)**	**1.27 (1.09-1.48)**	-	**1.17 (1.06-1.30)**	1.13 (0.97-1.33)	-
3	-	**1.38 (1.14-1.68)**	-	-	**1.26 (1.04-1.54)**	-
4	-	**1.32 (1.11-1.56)**	-	-	**1.22 (1.02-1.44)**	-
5 (most rural)	-	1.08 (0.81-1.45)	-	-	1.02 (0.76-1.37)	-
Tract						
t-RUCA 1 (most urban)	1	1	1	1	1	1
2	**1.18 (1.12-1.24)**	**1.17 (1.10-1.25)**	**1.17 (1.10-1.25)**	**1.09 (1.03-1.16)**	**1.08 (1.01-1.15)**	**1.08 (1.01-1.15)**
3	-	**1.29 (1.09-1.52)**	**1.18 (1.09-1.28)*** **	-	**1.20 (1.01-1.42)**	**1.11 (1.02-1.21)***
4 (most rural)	-	**1.16 (1.06-1.27)*** **	-	-	1.09 (0.99-1.20)*	-
Block/Block Group						
UA/UC 1 (most urban)	1	1	-	1	1	-
2	0.95 (0.90-1.01)	**1.18 (1.12-1.26)**	-	1.01 (0.95-1.08)	**1.14 (1.08-1.21)**	-
3 (most rural)	-	0.98 (0.92-1.04)	-	-	1.05 (0.99-1.11)	-

Adjusted models include the following covariates: race/ethnicity, age, year of diagnosis, census tract percent living in poverty, census tract percent black, and census tract percent Hispanic, and mammography access. Bold text indicates statistical significance of p<.05. ***linear test of trend p<.001 **linear test of trend p<.01 *linear test of trend p<.05

Fig. 1 Urban vs. Rural Classifications by County (NCHS, RUCC, UI), ZIP Code (ZIP-RUCA, FAR), Census Tract (RUCA), and Block/Block Group (UA/UC) Classification Methods



NCHS= National Center for Health Statistics; RUCC=Rural-Urban Commuting Code; UI=Urban Influence Codes FAR= Frontier and Remote Area Codes; RUCA=Rural Urban Commuting Area; ZIP-RUCA= ZIP-code RUCA; UA/UC=Urbanized area/Urban cluster

Appendix 1. Alternative categorizations of urban/rural measures

Urban/Rural measures by geographic unit and measure source documentation	Alternative categorizations for urban/rural measures	Number of breast cancer patients in each category	
County		N (%)	
UI: Urban Influence Code[16]	**Four categories:**		
	1. "Large metro" (code 1)	77,946 (64.6)	
	2. "Small metro" (code 2)	28,760 (23.8)	
	3. "Non-metro adjacent to metro" (codes 3-5)	7,592 (6.3)	
	4. "Noncore/non-adjacent areas" (codes 6-12)	6,440 (5.3)	
NCHS: National Center for Health Statistics Urban-Rural Classification Scheme[15,19]	**Six categories:**		
	1. "Large central metropolitan" (code 1)	55,940 (46.3)	
	2. "Large fringe metro" (code 2)	22,006 (18.2)	
	3. "Medium metro" (code 3)	14,660 (12.1)	
	4. "Small metro" (code 4)	14,100 (11.7)	
	5. "Micropolitan" (code 5)	7,857 (6.5)	
	6. "Noncore" counties (code 6)	6,175 (5.1)	
RUCC: Rural Urban Continuum Code[17], also known as Beale's codes	**Five categories[21]:**		
	1. "Large metropolitan" (code 1)	77,946 (64.6)	
	2. "Medium metropolitan" (code 2)	13,021 (10.8)	
	3. "Small metropolitan" (code 3)	15,739 (13.0)	
	4. "Urban nonmetropolitan" (codes 4–7)	13,369 (11.1)	
	5. "Rural nonmetropolitan" (codes 8-9)	663 (0.6)	
ZIP Code			
FAR: Frontier and Remote Area Code[10]	**Five categories:**		
	1. No FAR categorization (non-rural category)	11,6073 (96.1)	
	2. "Level 1"	1,731 (1.4)	
	3. "Level 2"	1,010 (0.8)	
	4. "Level 3"	1,386 (1.2)	
	5. "Level 4"	538 (0.5)	
zRUCA: ZIP-Code Rural Urban Commuting Area[11]	**Four categories /"Categorization A" :**	**ZIP**	**Tract**
	1. "Urban focused" (codes 1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, 10.1)	103,286 (85.6)	100,708 (83.4)
	2. "Large Rural City/Town" (Micropolitan) focused (codes 4.0, 4.2, 5.0, 5.2, 6.0, 6.1)	9,930 (8.2)	12,553 (10.4)
	3. "Small rural town focused" (codes 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2)	5,141 (4.3)	1,509 (1.3)
	4. "Isolated small rural town focused" (codes 10.0, 10.2, 10.3, 10.4, 10.5, 10.6)	2,381 (2.0)	5,968 (4.9)
	Three categories/"Categorization B":		
	1. "Urban" (1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, 10.1)	103,286 (85.6)	100,708 (83.4)
	2. "Large rural city/town" (4.0, 4.2, 5.0, 5.2, 6.0, 6.1);	9,930 (8.2)	12,553 (10.4)
	3. "Small and isolated small rural town" (7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2, 10.0, 10.2, 10.3, 10.4, 10.5, 10.6)	7,522 (6.2)	7,477 (6.2)
Census Tract			
tRUCA: Tract Rural Urban Commuting Area[18]	Same as z-RUCA, above	See above	
Block Group			
UA/UC: Urban Area/Urban Cluster[49]	**Three categories:**		
	1. "Urbanized area"	86,884 (72.2)	
	1. "Urban Cluster"	15,212 (12.6)	
	2. All other areas are designated as rural.	18,642 (15.4)	

RUCA Binary categorization is known as "Categorization C"

Appendix 2. Urban/Rural Classification of Texas Geography, Population, and Breast Cancer Cases using Multiple Classification Methods

	Texas Geography and Population			Texas Breast Cancer Cases			
	Number of Geographies n	Area %	Population %	Total (n=120,738) n (%)	Early (n=110,168) n (%)	Late (n=10,570) n (%)	p
Binary Classifications							
County[a]							
Urban	77	26.8	86.1	106,706 (88.4)	97565 (91.4)	9141 (8.6)	***
Rural	177	73.3	13.9	14,032 (11.6)	12603 (89.8)	1429 (10.2)	
ZIP Code							
Frontier and Remote Area Code (FAR)							
Urban	1308	46.5	94.5	116,073 (96.1)	106010 (91.3)	10063 (8.7)	***
Rural	587	53.5	5.5	4,665 (3.9)	4158 (89.1)	507 (10.9)	
Rural Urban Commuting Area (zRUCA)							
Urban	985	18.5	81.6	103,286 (85.6)	94,457 (91.5)	8829 (8.6)	***
Rural	910	81.5	18.4	17,452 (14.5)	15,711 (90.0)	1741 (10.0)	
Census Tract							
Rural Urban Commuting Area (tRUCA)							
Urban	3524	23.5	83.6	100,708 (83.4)	92117 (91.5)	8591 (8.5)	***
Rural	864	76.5	16.4	20,030 (16.6)	18051 (90.1)	1979 (9.9)	
Block/Block Group							
Urbanized Area/Urban Cluster (UA/UC)							
Urban	10798[b]	2.7	82.5	102,096 (85.6)	93097 (91.2)	8999 (8.8)	
Rural	3684	97.3	17.5	18,642 (15.4)	17071 (91.6)	1571 (8.4)	
Secondary Classification							
Block/Block Group							
Urban							
UA	9427	2.1	71.0	86884 (72.0)	79411 (91.4)	7473 (8.6)	***
UC	1371	0.6	11.5	15212 (12.6)	13686 (90.0)	1526 (10.0)	
Rural	3684	97.3	17.5	18,642 (15.4)	17071 (91.6)	1571 (8.4)	

*p<.01 **p<.001***p<.0001

[a]All three county-based methods agree: Rural Urban Continuum Code (RUCC), Urban Influence Code (UI), and National Center for Health Statistics Urban-Rural Classification Scheme for Counties (NCHS). [b]Texas geographies, areas, and population are calculated using block groups by assigning the block centroid to nearest block group.

Appendix 3. Unadjusted and adjusted association of urban/rural status and late-stage breast cancer across 7 classification methods (n=120,738) calculated from random intercept models (with random intercepts defined at the county, ZIP-code, census tract, and block group levels, as appropriate).

	Crude Odds Ratio (OR) and 95% CI			Adjusted Odds Ratio (aOR) and 95% CI		
	Method 1 (Binary Rural vs. non-rural)	Method 2	Method 3	Method 1 (Binary Rural vs. non-rural)	Method 2	Method 3
County						
UI 1 (most urban)	1	1	-	1	1	-
2	**1.21 (1.10-1.34)**	**1.15 (1.02-1.31)**	-	**1.14 (1.03-1.26)**	1.06 (0.94-1.20)	-
3	-	**1.28 (1.11-1.46)**	-	-	**1.18 (1.03-1.35)**	-
4 (most rural)	-	**1.33 (1.17-1.52)*****	-	-	**1.18 (1.03-1.35)****	-
RUCC 1 (most urban)	1	1	-	1	1	-
2	**1.21 (1.10-1.34)**	**1.31 (1.10-1.54)**	-	**1.14 (1.03-1.26)**	1.11 (0.94-1.32)	-
3	-	1.08 (0.94-1.24)	-	-	1.03 (0.90-1.19)	-
4	-	**1.30 (1.16-1.46)**	-	-	**1.17 (1.04-1.32)**	-
5 (most rural)	-	**1.38 (1.05-1.81)***	-	-	**1.33 (1.01-1.76)***	-
NCHS 1 (most urban)	1	1		1	1	
2	**1.21 (1.10-1.34)**	1.05 (0.85-1.29)	-	**1.14 (1.03-1.26)**	1.16 (0.94-1.42)	-
3	-	**1.33 (1.06-1.67)**	-	-	1.24 (0.99-1.55)	-
4	-	1.11 (0.90-1.38)	-	-	1.15 (0.93-1.42)	-
5	-	**1.41 (1.14-1.73)**	-	-	**1.36 (1.10-1.68)**	-
6 (most rural)	-	**1.30 (1.06-1.60)*****	-	-	**1.28 (1.04-1.58)****	-
ZIP-Code						
z-RUCA 1 (most urban)	1	1	1	1	1	1
2	**1.19 (1.11-1.28)**	**1.24 (1.13-1.37)**	**1.24 (1.13-1.37)**	**1.14 (1.06-1.23)**	**1.18 (1.08-1.30)**	**1.18 (1.08-1.29)**
3	-	**1.16 (1.03-1.30)**	**1.15 (1.05-1.27)*****	-	1.08 (0.97-1.21)	1.10 (1.00-1.21)
4 (most rural)	-	1.15 (0.98-1.34)	-	-	1.14 (0.97-1.34)	-
FAR 1 (most urban)	1	1	-	1	1	-
2	**1.27 (1.13-1.43)**	**1.26 (1.02-1.55)**	-	**1.18 (1.05-1.32)**	1.15 (0.95-1.38)	-
3	-	**1.40 (1.09-1.78)**	-	-	**1.29 (1.03-1.62)**	-
4	-	**1.30 (1.06-1.58)**	-	-	**1.21 (1.00-1.46)**	-
5 (most rural)	-	1.06 (0.78-1.45)	-	-	1.02 (0.76-1.39)	-
Tract						
t-RUCA 1 (most urban)	1	1	1	1	1	1
2	**1.18 (1.11-1.25)**	**1.17 (1.09-1.26)**	**1.17 (1.09-1.26)**	**1.09 (1.02-1.16)**	**1.08 (1.01-1.16)**	**1.08 (1.01-1.16)**
3	-	**1.28 (1.06-1.55)**	**1.18 (1.08-1.29)*****	-	1.19 (1.00-1.43)	**1.12 (1.02-1.22)***
4 (most rural)	-	**1.16 (1.05-1.28)****	-	-	1.09 (0.99-1.21)*	-
Block/Block Group						
UA/UC 1 (most urban)	1	1	-	1	1	-
2	0.96 (0.90-1.01)	**1.20 (1.13-1.27)**	-	1.02 (0.95-1.08)	**1.16 (1.08-1.24)**	-
3 (most rural)	-	0.99 (0.93-1.05)	-	-	1.06 (0.99-1.14)	-

Adjusted models include the following covariates: race/ethnicity, age, year of diagnosis, census tract percent living in poverty, census tract percent black, and census tract percent Hispanic, and mammography access. Bold text indicates statistical significance of OR at p<.05. ***linear test of trend p<.001 **linear test of trend p<.01 *linear test of trend p<.05

ing in a rural area varied considerably by definition. For example, the percent residing in rural areas ranged from 3.9% (zip code FAR) to 16.6% (tract RUCA). With the exception of the block group (UA/UC) definition, for all other definitions, rural residence (vs. non-rural) was significantly associated with a greater number of late- (vs. early) stage breast cancer cases ($p<.05$).

Figure 1 illustrates rural vs. non-rural areas as defined by measure. All 3 county-based definitions of rural vs. non-rural status agreed (1a). The two zip code definitions varied considerably, with a greater number of zip codes defined as urban when using the FAR vs. the zip-code RUCA approach (1b). There was only 1 census tract-based definition (1c). For block groups, those classified as within an urbanized area or urban cluster are considered non-rural in the binary comparison; but for comparison purposes, we differentiate these categories in the map (1d).

Overall, we found moderate to high levels of agreement between varying definitions of rural vs. non-rural residence among breast cancer cases (Table 3). As previously noted, all county-based definitions demonstrated perfect agreement. In all, for 72.9% of all patients, all 7 definitions agreed as to rural vs. non-rural residence. Percent agreement between all other comparisons ranged from 78.2-95.7%. PABAKs indicate nearly perfect agreement for 4 of the comparisons, substantial agreement for 5 comparisons, and moderate agreement for one comparison: tract-RUCA vs. block group.

Lastly, we examined the association of rural residence and late-stage disease using unadjusted and adjusted logistic regression. Overall, binary measures (rural vs. non-rural) indicate a generally consistent and moderate association between rural residence and late-stage breast cancer diagnosis (Table 4, Method 1). For all definitions with the exception of block group, unadjusted odds ratios of rural vs. non-rural residence were significant and ranged from 1.18 (tract-RUCA) to 1.21 (county definitions). In fully adjusted models, this adverse association is modestly attenuated but odds ratios remain significantly associated with late-stage diagnosis and range from 1.09 (tract-RUCA) to 1.14 (County definitions). Notably, rural residence as defined by the binary block group definition was not associated with late-stage diagnosis in either unadjusted or adjusted models.

Associations using various categorizations of urban/rural status are provided in Table 4 (Methods 2 and 3). Overall, findings suggest that compared to those in the most urban areas, those living in more rural areas are more likely to be diagnosed at late stage. However, associations were not always linear across categorizations; and not all categories were significant. Notably, when examining a secondary classification of block group residence, differences in odds of late-stage disease emerged. Specifically, compared to patients living in an urbanized area (the most urban), those living urban clusters were more likely to be diagnosed at late stage in adjusted models (aOR: 1.14; 95% CI: 1.08-1.21). However, residence in a rural area was not significantly associated with late-stage disease.

In sensitivity analyses, we fitted all models with a random intercept (i.e. we fitted 2-level hierarchical models) at the relevant geographic level (county, zip-code, census tract, or block group) to adjust for hierarchical clustering. Random intercept models are presented in Appendix 3. We observed no changes in the direction of effects and only very minor changes in the magnitude and significance of effect sizes displayed in Table 4, likely reflecting the impact of underestimated standard errors in the original analysis. These changes do not substantively alter the study conclusions.

DISCUSSION

Comparisons of Urban/Rural Measures

Overall, our study found moderate to high levels of agreement between measures of rural vs. non-rural residence. For 72.9% of our breast cancer cases, all 7 definitions agreed as to rural vs. non-rural residence. In general, comparisons among larger units (e.g. county-zip) demonstrated higher agreement. Comparisons using block group measures demonstrated the lowest agreement. The tract and ZIP versions of RUCA also demonstrated high agreement.

Overall, 6 of 7 definitions demonstrated a positive and adverse association between rural residence and late-stage disease in unadjusted and adjusted models.While contradicting some prior U.S. studies, [30,31] our results confirm a multiple other U.S. studies documenting rural disadvantage in late-stage breast cancer[23,32-34]. Indeed, our observed point estimates for a rural disadvantage in regional or late stage disease (adjusted OR ranged from 1.09-1.14) are very closely aligned to those observed in a recent meta-analysis. In a random effects model of 21 high-quality studies, rural (vs. urban) breast cancer patients had 1.19 higher odds (95% CI: 1.12-1.27) of late-stage and a 1.07 higher odds (95% CI: 1.04-1.10) of regional or late-stage breast cancer, respectively[3].

Few of the categorical measures demonstrated significant linear tests of trend across categories. While the majority of existing research has used binary measures of rural vs. non-rural, several previous studies have noted the lack of linear relationships across categories[35-38]. However, unlike a handful of prior studies from Illinois, we found no evidence of a "rural reversal."[11,12 37]. One of these studies found an "urban disadvantage" such that percent late-stage breast cancer was highest among Chicago residents, lower among those in Chicago suburbs, other metro areas, and large towns, but rates were also somewhat elevated among those living in small rural and isolated rural zip codes[36]. In this study, Chicago was compared to the remainder of Illinois, and findings to some degree may reflect the vulnerable and economically disadvantaged populations in inner-city Chicago. Regardless, such findings do raise some unanswered questions about the use of binary categories of urban vs. rural when studying geographic disparities in cancer outcomes.

Notably, only one binary measure of rural status was not associated with late-stage disease. The block group-based comparison demonstrated no difference in disease stage between rural vs. non-rural women. However, differences between block-group-based categories emerged when this measure was examined separately by urbanized area, urban cluster, and rural area. In this comparison, compared to urbanized areas (the most urban), those living in urban clusters, but not those in rural areas, were more likely to be diagnosed with late-stage disease (aOR: 1.14 95% CI: 1.08-1.21). The reasons for this are not clear. Compared to the other measures, the block group (BG) "rural" measure encompasses the largest amount of area and among the largest population (Appendix 2, Figure 1). This could result in more heterogeneity in this "rural" classification, resulting in the lack of an observed rural disparity. Just 12.6% of women with breast cancer in this study live in "urbanized clusters" (Appendix 2); many of whom (59%) are classified as "rural" using a county-based definition [data not shown]. While both are considered urban in our binary classification per standard practice, areas and clusters differ significantly in population density which ranges from ≥50,000 (urbanized areas) to 2,500-49,999 (urban clusters) residents per square mile[13]. When considering urban clusters as rural, rural (vs urban) women were more likely to be diagnosed with late-stage disease, consistent with findings using other measures.

The mechanisms driving rural disparity in breast cancer diagnosis stage are still uncertain. Possible hypothesized mechanisms include lack of insurance, poor spatial access to health care, including mammography access, lack of knowledge about screening guidelines, and lower use of mammography[33,39-43]. It will be important for future

studies to examine the mechanisms and pathways (i.e., mediation models) that explain the effects of rurality on stage at breast cancer diagnosis, and ultimately, to develop interventions that target the "root cause(s)" of rural disparities in breast cancer stage.

Recommendations and Future Research

The lack of consensus on how best to measure rural residence and the resulting diversity of methodologies was noted in both recent reviews of the cancer literature[2,3]. Our study, together with the meta-analysis by Nguyen-Pham et al.[3], provides some assurances in this regard. Namely, our results suggest that the use of different urban/rural measures is unlikely to be responsible for the mixed literature, at least in the limited case of breast cancer stage at diagnosis. It seems more likely that mixed findings result from different populations, geographies, settings, time periods, designs, and analytic methods applied in prior studies. However, the recent meta-analysis noted no clear patterns in findings across study differences such as sample size, year, patient age, cancer staging method, or control for covariates[3]. Clearer patterns may emerge as the evidence-base grows and we gain more insight from national samples/administrative databases, which will be greatly facilitated if studies are directly comparable.

Consistent use of a standardized measure of rural residence would facilitate comparisons across studies. Recently, Meilleur et al.[2] recommended use of the Rural Urban Commuting Area (RUCA) measure. This recommendation was based on conceptual considerations as well as a comprehensive and thoughtful review of the cancer outcomes literature. Our methodologic study builds from this review and extends the nascent evidence base regarding measurement of rural residence in the cancer literature. Given our findings—relatively high agreement and the largely consistent rural disparity in late-stage disease across measures—we support Meilleur et al.'s 2 recommendation of the RUCA. The RUCA measure incorporates both population density and travel distance, can be classified in multiple ways (i.e. with 2, 3, or 4 categories, including others not analyzed here) 20, and lends itself easily to multilevel regression analyses 2. Given the known spatial and temporal biases introduced by use of ZIP codes 7,8,44, and the ongoing convention of measuring neighborhood factors (e.g. percent poverty) using census tracts[44-46] we suggest researchers opt for census-tract RUCA if data permit.

While we compared some of the most frequently used measures, there are alternative ways to measure urban/rural status. Alternative approaches could alter findings in unknown ways. For example, it has been shown that traditional analysis using geopolitical boundaries may mask or attenuate differences between urban and rural populations[47]. Some researchers develop their own measures. For example, Robert et al. classified areas as 100% rural, mixed urban/rural, or 100% urban using percent of census tract or ZIP code residents living in census-defined urban areas and places[48].

Limitations and strengths

Our study faces several limitations. First, our results may not be generalizable to breast cancer patients living outside of Texas who may differ in unknown ways such as those facing different exposures to rural or urban environments. As one example, Texas has a large rural land mass compared to other states. Thus, individuals from other states living in rural areas may face much shorter travel times to reach an urban area and the healthcare facilities therein. Second, we faced data limitations. Data on multiple factors that might confound the association of rural residence and late-stage diagnosis were not available. Such factors might include primary care utilization, insurance status, or mammography use. Third, we included multiple variables in the adjusted models which may be on the causal pathway (e.g. mammography capacity). In doing so, we may have underestimated the association between rural residence and late-stage breast cancer. Finally, our study examines rural disparities in a single outcome—breast cancer stage at diagnosis; and we should not assume that results will hold across other cancer outcomes.

Conclusions

Our results document a clear rural disadvantage in late-stage diagnosis of breast cancer. Thoughtful and consistent use of RUCA codes to measure rural residence will facilitate comparisons across the currently heterogeneous cancer outcomes literature. In turn, these comparisons will help to elucidate the impact of rural residence on cancer outcomes across the cancer continuum. Continued research will be needed to elucidate the potential mechanisms such as healthcare access that underlie observed rural disparities.

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