SUPPLEMENTAL MATERIALS

Committee on Academic and Workforce Success

AGENDA ITEM VII-B

Update on initiatives related to providing healthcare to rural areas Justice

RECOMMENDATION: Information Item Only

Rationale:

THECB staff prepared the attached brief to provide Board members with additional information. The brief presents a summary of selected programs at the THECB and health-related institutions that directly or indirectly provide healthcare to rural areas.

Dr. Stacey Silverman, Deputy Assistant Commissioner for Academic Quality and Workforce will introduce this item. Panel presenters: Dr. Nancy Dickey, President Emeritus, Texas A&M University Health Science Center, and Mari Robinson, Director of Telehealth, The University of Texas Medical Branch Galveston, will present an update of institutional efforts currently underway to improve healthcare in rural areas.

60x30TX Initiatives to Address the Need for Healthcare Services in Texas Rural Areas

Selected Programs of the THECB and Texas Public Health-Related Institutions

As of 2017, approximately 170 of the 254 Texas counties are identified as rural; this is 24 fewer rural counties than in 1997. Interestingly, the total population of rural Texas remained relatively unchanged for the past 20 years, from just under 3 million in 1997 to just over 3 million in 2017. Even with fewer counties designated as rural, Texas continues to have serious healthcare needs in its rural areas. The individuals living in Texas rural counties have difficulty accessing healthcare services because of travel times, limited access to healthcare providers, and high rates of underinsured and uninsured residents. Compounding this is the reality that rural Texans have fewer financial resources and are older and less healthy than their urban counterparts. Access to healthcare services is also a challenge, as evidenced by the number of rural hospital closures since 2013. According to the Pew Research Organization, Texas closed the most rural hospitals of any state in the country, with 14 hospitals closing since 2013.

The Texas Higher Education Coordinating Board (THECB) is responsible for a limited number of programs that indirectly and directly impact healthcare services to Texans living in rural communities. These programs include the Family Practice Residency Program Rural Rotations, Physician Education Loan Repayment Program, and the Joint Admissions Medical Program. The THECB's Physician Education Loan Repayment Program allows eligible health professional graduates who have student loan debt to receive loan repayment assistance by providing healthcare to underserved populations, often in rural areas of high need. The Family Practice Rural Rotations encourage physicians in the early stages of their careers to consider rural healthcare practice.

The THECB also has programs that support efforts to increase the numbers of nurses in the state, improve the pipeline into allied health careers for underrepresented students, and provide loan repayment for nursing faculty, nurses providing mental health services, and other mental healthcare providers. This brief presents current information on a select group of programs at the THECB and Texas public institutions of higher education that have strong track records of providing healthcare services to rural areas or promoting rural practice to future physicians.

Texas public health-related institutions have some outstanding programs to address the need for rural physicians. This brief highlights institutional programs in place at Texas Tech University Health Sciences Center (Lubbock), University of North Texas Health Science Center (Fort Worth), The University of Texas Medical Branch at Galveston, The University of Texas M.D. Anderson Cancer Center (Houston), The University of Texas Health Science Center San Antonio, and Texas A&M University Health Science Center (College Station).

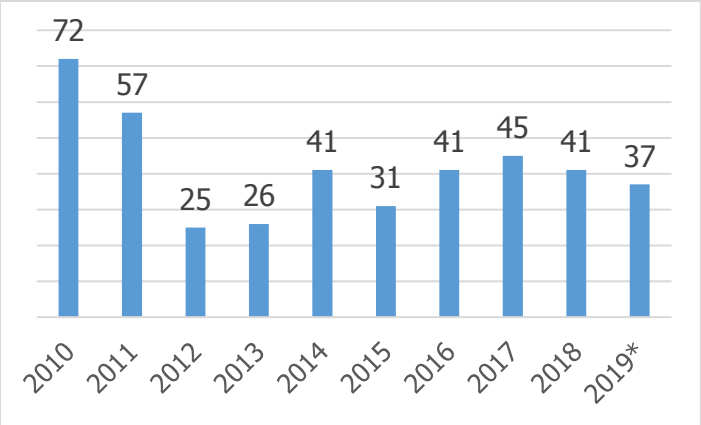
THECB's Family Practice Residency Program Rural Rotations

Through the Rural Rotations program, Texas family medicine residents receive training in one of the state's 29 family medicine residency programs and have an opportunity to spend a month in a rural community learning about family medicine and what being a family physician in a small Texas town is like. Physicians who participate in the Rural Rotations program gain an understanding of practicing medicine in rural Texas and tend to be more likely to practice in less populated Texas cities and rural areas.

The Rural Rotations program has a long history, as it was established by the Texas Legislature in 1989 and received state funding beginning in 1991. Rural rotations are supported by the THECB's Family Practice Residency Program, as directed by the state's General Appropriations Act. The annual allocation of funding to support rural and public health rotations is included in the Family Practice Residency Advisory Committee's annual funding recommendation to the THECB. The participating resident and the residency program receive funding under the program; however, the rural supervisors serve voluntarily and do not receive compensation for their services.

In Fiscal Year (FY) 2018, funding in the amount of $102,500 provided support for month-long rural rotations for 41 family medicine residents, which represented a slight decline in funding from FY 2017 funding in the amount of $107,500 that supported 43 rural rotations. An additional reduction in funding for the rural rotations will result in further decreases in the number of rural rotations that can be supported. In FY 2019, an estimated $92,500 will support 37 rural rotations. Participating family medicine residents receive a stipend of $1,000 upon completion of a rural rotation. In addition, residency programs receive funding of $1,500 for each resident who completes a rural rotation.

Figure 1. Family Practice rural rotations participation 2010-19.



From 2008 through 2015, 65 percent of the third-year family medicine residents (n=376) who completed a rural rotation remained in Texas to practice. Additionally, 8.2 percent of participants were identified as practicing in a rural Texas county. Only 30 percent of those practicing in Texas (n=71) were graduates of a Texas medical school, while all had completed a Texas family medicine residency program.

**Estimated*

Note: THECB has an exceptional item request to increase funding to the Family Practice Residency Program by $2,000,000 in the 2020-21 Biennium.

THECB's Physician Education Loan Repayment Program

The THECB's Physician Education Loan Repayment Program (PELRP) was established by the Texas Legislature in 1985 to provide loan repayment assistance to physicians practicing in Texas Health Professional Shortage Areas (HPSAs) and certain state agencies. The program is one of the first state student loan repayment programs in the country and established the THECB's model for loan repayment programs. PELRP requires that a year of service be completed by the participant before state funds are disbursed. This approach ensures that qualifying areas receive healthcare services before state funds are expended.

For the majority of PELRP's existence, its funding came primarily from dedicated medical school tuition set asides, and the rest, approximately 20 percent, from General Revenue. The PELRP originally provided loan repayment of up to $9,000 per year, for up to five years to qualifying physicians. By the late 1990s, other states had established loan repayment programs that provided much larger amounts, raising concerns in Texas about the need for the PELRP to be more competitive. Additionally, student loan indebtedness for graduating medical students had increased considerably.

In 2009, the Texas Legislature revised the funding stream for the program through changes to the code for smokeless tobacco, which provided a substantial increase to the PELRP. The award amounts are based on the expectation that participating physicians would agree to provide at least four years of service in an area of need and would receive up to a maximum of $160,000 in repayment of student loans over that time. Physicians with lower loan debt receive repayments in proportionate amounts required to repay the loans in full over the four-year period.

The primary purpose of the PELRP is to encourage qualified physicians to practice medicine in a Health Professional Shortage Area (HPSA), as designated by the U.S. Department of Health and Human Services, and to provide health care services to persons enrolled in Medicaid and the Children's Health Insurance Program. Priority is given to primary care physicians who practice in a rural HPSA. In FY 2018, approximately 29 percent of the PELRP recipients were practicing in a rural HPSA.

The following are considered primary care physicians for loan repayment through PELRP: Family Medicine/Family Practice; General Practice; Obstetrics/Gynecology; General Internal Medicine; Medicine-Pediatrics; General Pediatrics; Psychiatry; Geriatrics; and hospitalists. Subspecialists practicing in HPSAs may qualify if funds remain available after applications from primary care physicians have been considered. Additionally, if funds remain available, physicians may qualify under an "alternative pathway" for non-HPSA physicians who have met established service levels for persons enrolled in Medicaid and Healthy Texas Women.

Table 1. PELRP funding and new physicians enrolled.

Fiscal Year	Appropriated Dedicated General Revenue	Biennial Appropriation	New Physicians Enrolled
FY 2010	$7,000,000	$22,000,000	102
FY 2011	$15,000,000		43
FY 2012	$5,600,000	$5,600,000	0
FY 2013*	$0		138
FY 2014	$4,300,000	$33,800,000	89
FY 2015	$29,500,000		92
FY 2016	$16,900,000	$33,800,000	96
FY 2017	$16,900,000		129
FY 2018	$12,675,000	$25,350,000	82
FY 2019**	$12,675,000		-
**Unencumbered balance from FY2012 carried forward to FY 2013*			
***Participation has not yet been determined.*			

Funding for the PELRP has varied, resulting in a fluctuating amount of available funds to support renewal awards for physicians already enrolled in the program, in addition to enrollment of new physicians in the program. PELRP loan repayment is awarded so that a physician who commits to practicing in an HPSA will receive loan repayment for a maximum of four years for up to $160,000, if appropriated funds remain available. Participants receive loan repayment following completion of each year of service. A physician who owes $160,000 or more in student loans receives increased funding each year in the program, beginning with $25,000 in year one and ending with $55,000 in year four.

THECB and TMDSAS's Joint Admissions Medical Program (JAMP)

The Joint Admission Medical Program (JAMP) was created by the 77th Texas Legislature in 2001 to support and encourage highly qualified, economically disadvantaged Texas resident students pursuing a medical education. Funded through the THECB, JAMP is a unique partnership among nine Texas medical schools and 68 public and private four-year undergraduate institutions.

The pipeline program provides services to support eligible undergraduate and medical students. Participating JAMP students receive a scholarship each semester beginning in their sophomore year of college. Undergraduate students also receive a stipend to attend summer internships following their sophomore and junior years. JAMP students receive mentoring and personal assistance to prepare for medical school while attending college. Most importantly, if they fulfill all requirements, these students receive a guarantee of admission to attend a Texas medical school.

The first cohort of JAMP students was selected in 2003, and since that time more than 1,700 students have participated in the program, with 461 graduating from a Texas medical school. As of fall 2018, 66 percent of the JAMP medical school graduates entered a medical residency training program in Texas. Additionally, a majority of JAMP medical school graduates (64%) entered residency training to become a primary care physician. By implementing statewide programing, JAMP has successfully expanded medical education outreach to high school and undergraduate students. In addition, JAMP provides resources to undergraduate programs for faculty support, curricular development, and extracurricular programming.

The THECB contracts with the JAMP Council to maintain and administer the program through The University of Texas System Office, Texas Medical and Dental Schools Application Service

(TMDSAS). Funding is awarded in the first year of the biennium, and the program expends the funds over two years. For the 2018-19 biennium, JAMP received an appropriation of $10,206,794.

Since 2003, JAMP has been helping Texas students achieve their dreams by offering guaranteed admission to one of the state's medical schools; financial and academic support to help them get there; and access to resources that allow them to excel.

Texas Tech University Health Sciences Center (TTUHSC), Lubbock - Family Medicine Accelerated Track

The Family Medicine Accelerated Track (FMAT) is an innovative three-year accelerated medical school curriculum that culminates in a Doctor of Medicine (MD) degree and leads graduates directly into a three-year family medicine residency in Lubbock, Amarillo, or the Permian Basin. Applicants to the TTUHSC School of Medicine may apply to the accelerated track when they submit their medical school application or during their first fall semester of medical school.

The TTUHSC FMAT received a $229,492 grant from the THECB in 2015 and received a second grant of $328,800 in 2016 through the Primary Care Innovation Program. The following information provides a summary of the FMAT program's participation and effectiveness.

TTUHSC's FMAT program targets Family Medicine because it is the medical specialty that distributes itself in geographic locations that mirror the state's general population. Other primary and specialty physicians locate in densely populated areas of the state. Family Medicine residents also remain in primary care, even those Family Medicine residents who pursue additional training in geriatrics, palliative medicine, or sports medicine.

TTUHSC's FMAT program started in 2011, with eight students who graduated from TTUHSC School of Medicine in 2013 and completed a TTUHSC Family Medicine residency program in Lubbock or Amarillo in June 2016. The accelerated track experienced an 81.25 percent completion success for its first six classes. As of 2018, 45 students have graduated from the TTUHSC School of Medicine with the MD through the FMAT program; 20 have completed residency training; 25 continue as residents in TTUHSC programs in Amarillo (4), Lubbock (18), and Odessa (2); and one is in training at John Peter Smith in Fort Worth. The accelerated track experienced a 79 percent completion success for its first six classes. Also, as of the 2018-2019 academic year, 16 FMAT students are second- or third-year medical students, and a class of 10 to 12 students from among the current first-year class are expected to begin FMAT training in June of 2019.

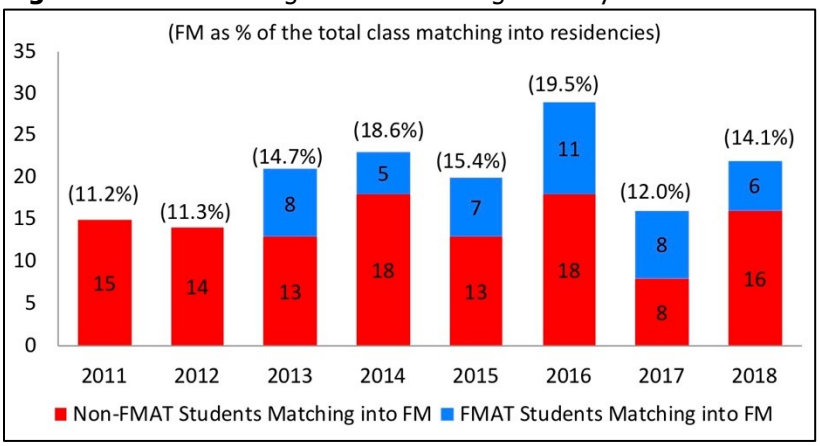
The accelerated track is particularly attractive for students with West Texas ties who are interested in primary care. TTUHSC reported that the FMAT effectiveness is promising and that medical students have shown a clear interest in pursuing the accelerated track.

In 2012, 11.3 percent of TTUHSC medical graduates entered Family Medicine residencies. With the implementation of the accelerated track in 2013, that number increased to 15.38

percent and continued on an increasing trajectory in 2014 to 18.55 percent of the class. By 2016, 19.5 percent of TTUHSC students matched with Family Medicine, as shown in Figure 2. In 2018, 14.1 percent of TTUHSC students chose Family Medicine residencies, including six from the FMAT program. TTUHSC remains above the national average of 9.3 percent of match rate of U.S. medical school seniors into Family Medicine, according to American Association of Family Physician data for 2018 (https://www.aafp.org/medical-school-residency/program-directors/nrmp.html).

An October 2016 article published in Family Medicine (Kozakowski et al) included a rank order list of the top 20 MD-granting medical schools using a three-year rolling average of family medicine graduation rates; TTUHSC was included in that top-20 list, with 15.5 percent of TTUHSC graduates from 2015 in Family Medicine residencies (compared to Texas' overall rate of 10.3%).

Figure 2. TTUHSC MD graduates entering a Family Medicine Residency Program.



TTUHSC identified several factors that helped attract students who likely would not have gone into Family Medicine, including financial considerations, shorter training-to-practice time, increased primary care status and visibility, and other support.

Financial Considerations: FMAT students accrued about half the debt compared to traditional students. This was likely a result of a scholarship in the second year of medical school and receiving a resident's salary one year earlier. While the role of debt in students' specialty selection is complex, TTUHSC student surveys showed that debt reduction was a key motivator for participation.

Shorter Training-to-Practice Time: The FMAT program is especially appealing to students returning to medical school as a second career. Roughly half of each FMAT class is comprised of older students and many are parents. TTUHSC reported that these nontraditional students were eager to finish their education and begin practice. Such students were more comfortable making specialty and residency choices in their first year of medical school.

Increased Primary Care Status and Visibility: The FMAT program enjoys a high level of visibility and status at TTUHSC among both students and faculty. The challenging nature of an accelerated program requires and attracts high-achieving students who can manage multiple demands.

Other Support: FMAT also offers students effective mentoring, especially in their second year of medical school. Students begin more intensive clerkship training one year earlier, with both inpatient and ambulatory experiences. TTUHSC also provides FMAT students with United States

Medical Licensing Examination (USMLE) Step exam training, iPads to access electronic resources, and travel opportunities to represent the program at national meetings.

University of North Texas Health Science Center, Texas College of Osteopathic Medicine (UNTHSC-TCOM), Fort Worth - Rural Scholars Program *(Accessed online)*

In 1996, the UNTHSC-TCOM, Department of Family Medicine began implementing an articulated Rural Family Medicine Track program. The community-based curriculum introduced medical students to the practice of family medicine in a rural environment. During its 14-year history, more than 100 students completed the Rural Track, and many chose primary care residencies and rural practices.

The success of the Rural Track program provided the foundation for development of an enhanced curriculum in rural medicine – **Rural Osteopathic Medical Education of Texas (ROME)**. This curriculum extends the original emphasis of rural family medicine to a full rural medicine curriculum designed to prepare graduates for practice in a rural environment. This introduction to the foundations of rural medicine and skills training translates to a high level of competency early in medical education.

The Division of Rural Medicine was created to develop and implement this expanded rural initiative. Implementation began in 2006, and the first cohort of ROME students graduated in May 2010.

In 2010, the Division of Rural Medicine became the **Office of Rural Medical Education** for the Texas College of Osteopathic Medicine. With this change, new programs are under development. The "ROME curriculum" as it has been known since 2006, is now called the **Rural Scholars Program**. This curriculum and other rural initiatives continue to evolve through collaborative relationships with healthcare professionals, rural hospitals, clinics, and agencies across the state. ROME now includes additional experiences in International and Global Health.

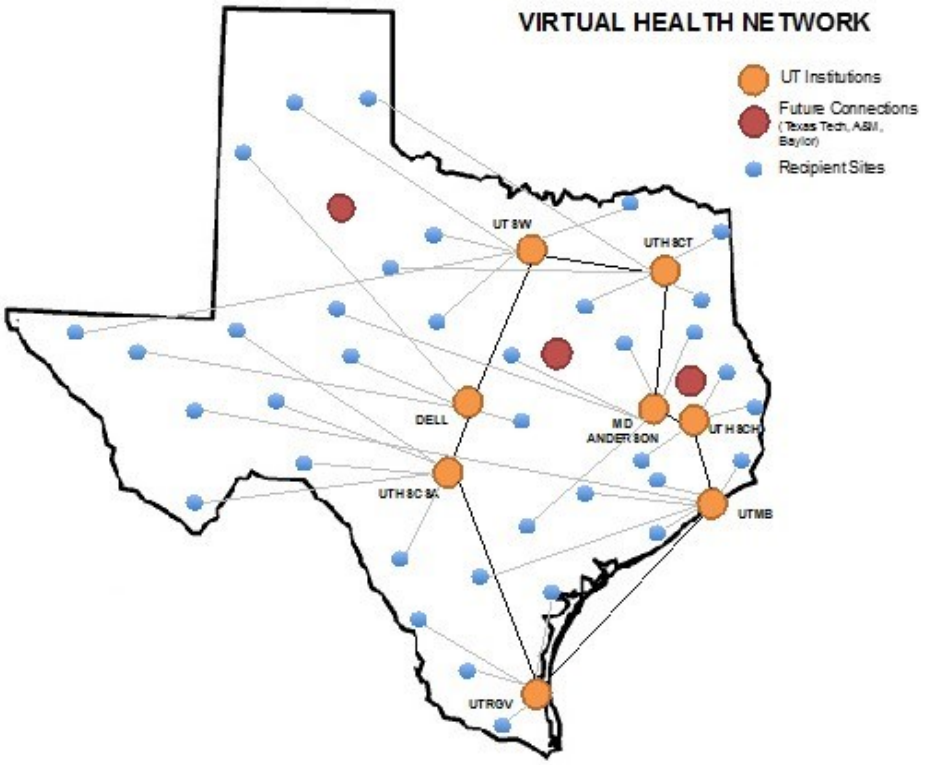
The University of Texas Medical Branch at Galveston (UTMB) – UT-System Virtual Health Network (UT-VHN)

UTMB is coordinating and implementing a University of Texas System (UT-System) initiative connecting its health science centers and medical schools under one statewide telemedicine network. The initiative will create a model that eventually could be adopted statewide and include several higher education systems and institutions.

Approved by its board of regents in 2016, the UT-System Virtual Health Network (UT-VHN) builds on the system's existing telehealth capabilities and will allow more patients to have access to specialty care without driving hundreds of miles. It will provide Texans in rural communities with more efficient opportunities to seek the care they need, with an overall goal of reducing patient transfers. A coordinated telemedicine and telehealth system also will allow providers in rural and smaller community hospitals greater ability to provide care for patients.

The current and future potential sites that could be supported through UT-VHN are shown in Figure 3.

Figure 3. UTMB, UT System Virtual Health Network



The UT-VHN was started with $10.8 million in endowment proceeds that will support UT-VHN's development, including equipment and technical support. UTMB physicians provide care via telemedicine to deliver health services remotely to Texas prison inmates, offshore oil workers, researchers in Antarctica, and others. UTMB has logged an annual average of 99,000 physician-to-patient telemedicine encounters in recent years.

The University of Texas MD Anderson Cancer Center and The University of Texas Health Science Center San Antonio - Project ECHO MD Anderson, UTHSC San Antonio *(Accessed online)*

Project ECHO (Extension for Community Healthcare Outcomes) is a telementoring program that was first developed to extend and improve treatment options for patients in rural and medically underserved areas. Since its inception at the University of New Mexico in 2003, Project ECHO has expanded into a movement that links rural health care providers with physician specialists to provide best practice care for underserved people worldwide, but it grew out of an effort to meet local healthcare needs.

In Project ECHO programs, physician specialists working at major healthcare "hubs" partner with rural providers and those working in underserved regions, and offer mentoring, guidance,

and training using teleconferencing technology. The program now has 109 partners working in 21 countries to improve treatment for almost 60 conditions. As a designated superhub, The University of Texas MD Anderson Cancer Center (UTMD Anderson) now trains other healthcare institutions to develop their own Project ECHO initiatives, and the number of UT-System institutions who serve as Project ECHO hubs is increasing.

UTMD Anderson assumed its new role as a superhub in early 2017 and began offering Project ECHO training to other health institutions interested in beginning their own programs. Representatives from The University of Texas Health Science Center at Tyler (UTHSC Tyler), The University of Texas Health Science Center at San Antonio (UTHSC San Antonio), and others have attended training sessions. Other attendees have traveled from Louisiana and West Virginia. Members of the National Cancer Institute – Center for Global Health and the International Gynecologic Cancer Society also have attended training.

By placing clinicians together with specialist teams at academic medical centers in weekly virtual clinics or teleECHO™ clinics, Project ECHO shares knowledge and expands treatment capacity. The result: better care for more people. A 2011 study published in the *New England Journal of Medicine* showed that the quality of hepatitis C care provided by Project ECHO-trained clinicians was equal to that of care provided by university-based specialists. Furthermore, Project ECHO has expanded—across diseases and specialties, across urban and rural locales, across different types of delivery services, and even across the globe. Today, Project ECHO operates more than 220 hubs for more than 100 diseases and conditions in 31 countries.

Texas A&M University Health Science Center (TAMUHSC), College Station

A new partnership between TAMUHSC and Blue Cross began in 2018 and will explore how to address rural healthcare challenges. The project will engage the expertise of the TAMUHSC healthcare professions, including dentistry, medicine, nursing, pharmacy, and public health, while also including the departments of agriculture, education, and engineering. The project will focus on rural healthcare delivery systems, rural hospital function and futures, community empowerment, and technology and health information.

State Health Information Resources and Recent Articles

Resources:

Rural Health Information Hub -- https://www.ruralhealthinfo.org/states/texas

Texas Association of Rural Health Clinics -- http://www.tarhc.org/

Texas Department of Agriculture, State Office of Rural Health -- http://www.texasagriculture.gov/GrantsServices/RuralEconomicDevelopment/StateOfficeofRuralHealth.aspx

Texas A&M Health Science Center (TAMHSC), A&M Rural and Community Health Institute (ARCHI) -- https://architexas.org/

Texas e-Health Alliance, www.txeha.org

Texas Organization of Rural Communities and Hospitals, https://www.torchnet.org/

Texas Rural Health Association -- http://www.trha.org/

Texas Tech University Health Sciences Center -- http://www.ttuhsc.edu/rural-health/

Urban Institute, State Uninsured Data -- https://www.urban.org/policy-centers/health-policy-center/projects/characteristics-uninsured-texas

Recent Articles:

Health Suffers Deep in the Troubled Heart of Texas, https://khn.org/news/health-suffers-deep-in-the-troubled-heart-of-texas/

Project ECHO brings changes to rural healthcare, https://www.utsystem.edu/sites/texas-health-journal/story/project-echo

Rural practice, keeping physicians in (Position Paper), https://www.aafp.org/about/policies/all/rural-practice-paper.html

Rural residencies: Texas Tech's Rural Training Track brings more physicians to small towns, https://www.texmed.org/Rural/

Texas A&M welcomes national center to improve rural health care, https://vitalrecord.tamhsc.edu/texas-am-welcomes-national-center-to-improve-rural-health-care/

Entry of US Medical School Graduates Into Family Medicine Residencies: 2015–2016, https://www.stfm.org/FamilyMedicine/Vol48Issue9/Kozakowski688

National Information Resources and Recent Articles

Resources:

3RNet Healthcare Jobs Across the Nation, https://www.3rnet.org/search-opportunities/p/-1/s/-1/st/46

Center on Rural Innovation, https://ruralinnovation.us/rural-opportunity-map/

National Association of Rural Health Clinics, www.narhc.org

National Rural Health Association, www.ruralhealthweb.org

National Rural Health Resource Center, www.ruralcenter.org

Rural Health Research Gateway, https://www.ruralhealthresearch.org/recaps

Recent Articles:

For Rural Americans, Healthcare and Hospitals Can Be Far Away, https://www.citylab.com/equity/2018/12/rural-americans-hospitals-healthcare-travel-times-far/578305/

How far Americans live from the closest hospital differs by community type, http://www.pewresearch.org/fact-tank/2018/12/12/how-far-americans-live-from-the-closest-hospital-differs-by-community-type/

Evaluation of Policy Options for Increasing the Availability of Primary Care Services in Rural Washington State, https://www.rand.org/pubs/research_reports/RR1620.html

Journal Publications on Rural Healthcare

Bolin, J. N., Bellamy, G., Ferdinand, A. O., Kash, B. A., & Helduser, J. W. (2015). Rural healthy people 2020. *The Journal of Rural Health, 31*, 326-333.

The purpose of this nationally disseminated survey was to gauge rural health priorities from rural stakeholders (the majority were providers, administrators, and educators). Access to healthcare was identified by rural stakeholders as the number one priority in their areas, followed by nutrition and weight status, diabetes, mental health, and substance abuse. Health disease and stroke, physical activity, age, maternal and infant health, and tobacco use were also considered, but scored lower as priorities.

Cosby, A. G., Neaves, T. T., Cossman, R. E., Cossman, J. S., James, W. L., Feierabend, N., Mirvis, D.M., Jones, C.A. & Farrigan, T. (2008). Preliminary evidence for an emerging nonmetropolitan mortality penalty in the United States. *American Journal of Public Health*, *98*(8), 1470-1472.

People living in rural areas have higher mortality rates than those in urban areas. This is known as the mortality penalty. Beginning in 1990, while mortality rates across the United States were in decline, mortality rates in "nonmetropolitan" areas began to decrease at a slower rate than mortality rates in metropolitan areas. The authors posited that the amount of excess deaths in nonmetropolitan areas may be due to disparities in access to health care.

Harris, J. K., Beatty, K., Leider, J. P., Knudson, A., Anderson, B. L., & Meit, M. (2016). The double disparity facing rural local health departments. *Annual review of public health*, *37*, 167-184.

Deficiencies in access to healthcare in rural areas and limited resources (financial, human resources, technology) in rural local health departments (LDHs) has led to a focus on providing direct services in rural areas rather than participating in public health initiatives. This could explain some disparities in health outcomes for people in rural areas.

James, C. V., Moonesinghe, R., Wilson-Frederick, S. M., Hall, J. E., Penman-Aguilar, A., & Bouye, K. (2017). Racial/ethnic health disparities among rural adults—United States, 2012–2015. *MMWR Surveillance Summaries*, *66*(23), 1.

All populations in rural areas have their own health-related challenges, however, minority populations are more likely to be uninsured and are more likely to describe themselves as of being in poor health. There may be differences in health outcomes for minority populations by geographic area, but more research is needed. The authors suggest that rural hospitals conduct community needs assessments to better serve these populations.

Matthews, K. A., Croft, J. B., Liu, Y., Lu, H., Kanny, D., Wheaton, A. G., Cunningham, T.J., Khan, L.K., Caraballo, R.S., Holt, J.B. & Eke, P. I. (2017). Health-Related Behaviors by Urban-Rural County Classification-United States, 2013. *Morbidity and mortality weekly report. Surveillance summaries (Washington, DC: 2002)*, *66*(5), 1-8.

Based on a national telephone survey, researchers found that people in rural areas reported less engagement in five health-related behaviors (not smoking, maintaining normal body weight, engaging in physical activity, practicing non-drinking or moderate drinking, and getting sufficient sleep) than did people in more urban areas. These health-related behaviors are associated with prevention of the leading chronic causes of death. The authors suggest efforts to increase public awareness and education around these health-related behaviors in rural areas.

Meit, M., Knudson, A., Gilbert, T., Yu, A. T. C., Tanenbaum, E., Ormson, E., & Popat, M. S. (2014). The 2014 update of the rural-urban chartbook. *Bethesda, MD: Rural Health Reform Policy Research Center*.

Using national data, the authors compared health indicators for counties in the United States, categorized by urbanization level. People in more rural areas tend to engage in more risky health behaviors, are more likely to live in poverty, are older on average, and have poorer health outcomes overall. There are also disparities in physician supply across all medical specialties in rural areas. This report contains many graphic representations of health behavior and healthcare disparities by urbanization level.

Moy, E., Garcia, M. C., Bastian, B., Rossen, L. M., Ingram, D. D., Faul, M., Massetti, G.M., Thomas, C.C., Hong Y., Yoon, P.W. & Iademarco, M. F. (2017). Leading Causes of Death in Nonmetropolitan and Metropolitan Areas-United States, 1999-2014. *Morbidity and mortality weekly report. Surveillance summaries (Washington, DC: 2002)*, *66*(1), 1-8.

The mortality penalty holds true across all five leading causes of death - heart disease, cancer, unintentional injury, chronic lower respiratory disease, and stroke. According to this study, the percentage of possibly excess deaths is higher for persons living in rural areas as is the age-adjusted death rate. The authors recommend more research in this area to determine the reasons behind these disparities.

Journal Publications on Telemedicine

Amadi-Obi, A., Gilligan, P., Owens, N., & O'Donnell, C. (2014). Telemedicine in pre-hospital care: a review of telemedicine applications in the pre-hospital environment. *International journal of emergency medicine*, *7*(1), 29.

The authors examined available literature on the use of telemedicine in emergency medical care. Most evidence is in the positive effect of telemedicine in stroke management. The authors also examine articles related to trauma and myocardial infarction but evidence for the benefits of telemedicine is inconclusive in those cases. The advantage of telemedicine may be in pre-hospital diagnosis which can potentially improve patient outcomes in emergency situations.

Bashshur, R. L., Shannon, G. W., Smith, B. R. (2014). The empirical foundations of telemedicine interventions for chronic disease management. *Telemedicine and e-Health*, *20*(9), 769-800.

Authors examined the available literature on the use of telemedicine in the management of congestive heart failure, chronic obstructive pulmonary disease, and stroke (three leading causes of death). They found that the evidence generally pointed to the advantages of telemedicine when it came to early and accurate diagnosis and referral, reductions in hospitalization, and patient outcomes including mortality and patient satisfaction with care. Authors acknowledged that telemedicine is a broad term and that studies varied widely in methodology and outcomes measured.

De La Torre-Díez, I., López-Coronado, M., Vaca, C., Aguado, J. S., & de Castro, C. (2015). Cost-utility and cost-effectiveness studies of telemedicine, electronic, and mobile health systems in the literature: a systematic review. *Telemedicine and e-Health*, *21*(2), 81-85.

According to this meta-analysis of the cost-effectiveness of telemedicine, evidence is inconclusive as to whether telemedicine is less expensive than traditional medicine. That said, the available literature has significant limitations. Most studies examine cost-effectiveness only, with no examination of how telemedicine affects patient care. Also it is difficult to generalize across different methods of telemedicine delivery. Long-term studies should be done to properly gauge cost-effectiveness.

Dorsey, E. R., & Topol, E. J. (2016). State of telehealth. *New England Journal of Medicine*, *375*(2), 154-161.

The purpose of telemedicine has changed over time: from providing access to healthcare to providing convenient healthcare, from addressing acute conditions to addressing episodic and chronic conditions, from being delivered in hospitals and health clinics to being delivered in the home with mobile devices. The authors suggest that policy is necessary to ensure that telemedicine increases access to healthcare for all and does not intensify current health care access gaps.

Marcin, J. P., Shaikh, U., & Steinhorn, R. H. (2015). Addressing health disparities in rural communities using telehealth. *Pediatric Research*, *79*(1-2), 169.

Telemedicine addresses the problem of lack of access to healthcare, especially specialized healthcare, for children in rural and underserved areas and thereby improves health outcomes. Telemedicine has also been shown to improve satisfaction for patients, families, and providers and to be cost effective. The authors suggest that telemedicine can address discrepancies in distribution of pediatric specialists in rural areas especially.

Mehrotra, A., Jena, A. B., Busch, A. B., Souza, J., Uscher-Pines, L., & Landon, B. E. (2016). Utilization of telemedicine among rural Medicare beneficiaries. *JAMA*, *315*(18), 2015-2016.

Telemedicine use among Medicare beneficiaries increase 28 percent annually between 2004 and 2013. Generally, those who make use of Medicare telemedicine visits in rural areas are more likely to be poor, have more comorbidities, use Medicare because of disability and be seeking treatment for a mental illness. Most visits were at outpatient clinics and 78.9 percent of visits were for mental health.

Ward, M. M., Jaana, M., & Natafgi, N. (2015). Systematic review of telemedicine applications in emergency rooms. *international journal of medical informatics*, *84*(9), 601-616.

In a review of literature about emergency care in urban and rural areas, authors found that evidence was positive that telemedicine could aid small and rural hospitals in situations where specialist consultation was necessary. In addition, studies found that provider and patient satisfaction was high when telemedicine was used. That said, the authors noted the limitations in most studies of telemedicine. Most studies are done in one setting, without a control group, and after telemedicine was applied, thus it is difficult to generalize findings.