Article
Themed Issue: Radiation Effects and Events

The Houston-Semipalatinsk Healthcare Partnership: A Lesson in Science Diplomacy

Rishi Shridharan[1], Larry Laufman[2], Sara Rozin[3], and Armin Weinberg[4]

[1] MD/PhD Student, Perelman School of Medicine, University of Pennsylvania
[2] Associate Professor, Department of Medicine and the Center for Medical Ethics and Health Policy, Baylor College of Medicine
[3] Founder, Houston Health Concierge
[4] Clinical Professor, Baylor College of Medicine, and Adjunct Professor, Rice University

Abstract:
The 1995–99 Houston-Semipalatinsk Healthcare Partnership (HSP) was an international collaboration between healthcare institutions in Houston, Texas, and Semey, Kazakhstan (previously called Semipalatinsk). This partnership was established to create a synergistic exchange that would address public health needs identified by Kazakh institutions and that would be self-sustaining. Semey was the primary site of Soviet-era atomic bomb testing for over forty years, exposing millions of people to sustained radiation. When the Soviet Union was dissolved, Semey's healthcare infrastructure was insufficient to care for the existing population, let alone deal with the added health effects of low-dose radiation. To address these challenges, the HSP was established with funding through the American International Health Alliance (AIHA), under a cooperative agreement with the United States Agency for International Development (USAID). Houston and Semey partners jointly formulated goals for healthcare reform and mobilized resources across institutions and governments. Through cultural, economic, educational, and technical exchange, the partnership afforded unique advantages as an international program of medical, scientific, and socioeconomic alliances. The many accomplishments of this partnership illustrate the efficacy of this collaborative approach and highlight the crucial need for government support of sustained programming to make transformative progress.

Keywords: science diplomacy, health effects of radiation, cancer, international partnership, sustainability

Introduction and Context

In northeastern Kazakhstan, close to the border with China, lies Semey (previously named Semipalatinsk), a "secret city" of 350,000 people that was unknown to the West until 1991. It is located about fifty miles east of the Polygon and was selected by Joseph Stalin in 1949 to be the secret nuclear test site for the Soviet Union, also known as the

Polygon. The Soviet Union carried out upwards of 450 nuclear tests at the Polygon from 1949 to 1989, exposing an estimated 1.5 million people to radiation during the forty-year span.[1] Recognizing the need for remediation after the fall of the Soviet Union, US Congress passed the Nunn-Lugar Act, launching the Cooperative Threat Reduction (CTR) Program within the Defense Threat Reduction Agency. A portion of CTR funding went to a covert program, Project Sapphire, tasked with transportation of weapons-grade uranium from the test site to secure storage.[2]

Under the auspices of these funding acts, which recognized needs in the healthcare system posed by the Soviet Union's dissolution and large-scale radiation exposure, the United Methodist Church's General Board of Global Ministries (GBGM) decided to become involved.[3] Thus, in 1995, the Houston-Semipalatinsk Healthcare Partnership (HSP) was established with funding through the American International Health Alliance (AIHA), under a cooperative agreement with the United States Agency for International Development (USAID). Initial partner institutions in Houston, Texas, included The Methodist Hospital (TMH, now named Houston Methodist Hospital) and Baylor College of Medicine (BCM), and eventually expanded to include the Texas Children's Hospital (TCH), the Michael E. DeBakey Veterans Affairs Medical Center (MEDVAMC), and the Harris County Hospital District (HCHD; now named the Harris County Hospital System, HHS). In Semey, partnerships were established with the Regional Administration, the

Image Description: Initial signing ceremony for HSP's memorandum of understanding with Randall P. Wright signing on behalf of TMH (now named Houston Methodist Hospital. Image courtesy of Armin Weinberg

Regional Oncology Dispensary, the Regional Clinical Hospital, the Regional Children's Hospital, the Emergency First Aid Hospital, the Gynecological Hospital, the Regional Diagnostic Treatment Center in Kurchatov, Semey Medical Academy (for training of physicians), and Semey Medical College (for training of nurses). Table 1 lists the partner institutions and their roles in the HSP.

The partnership had many impacts in various areas, listed in detail in Table 2. Key programmatic elements, along with selected accomplishments in each of nine domains, are discussed below. These nine areas emphasize outcomes benefitting Semey's healthcare infrastructure, with additional clarification on major advancements noted in the text. Multiple outcomes went beyond the scope of original partnership documents and were the product of networking among many organizations to foster reciprocal exchange.

The HSP, working in conjunction with the United Nations, culminated in the Tokyo International Conference on Semipalatinsk in Tokyo, Japan over September 6–7, 1999.[4] Through its many achievements, this partnership was at the fore of science diplomacy, which the American Association for the Advancement of Science encourages as a way to "build bridges between communities, societies, and nations through closer interactions between science and diplomacy and elevate the role of science in foreign policy."[5]

Such efforts to increase government support for sustained programming in health effects of low-dose radiation are becoming increasingly visible, through recent texts demonstrating the need for studies, and a National Academies of Sciences, Engineering, and Medicine report from the Committee on Developing a Long-Term Strategy for Low-Dose Radiation Research in the United States.[6] Nevertheless, more action is needed, and the efficacy of the HSP stands as a testament to the value of sustained, cross-institutional, international collaboration.

Program Areas and Key Accomplishments

Partnership activities typically involved visits to Houston and Semey of varied duration, typically one week to one month. Nine program areas, mutually determined by both partners, were designed as key areas to address.

1. Cancer Registry and Screening

Reports of health effects arising from nuclear testing included extraordinarily high levels of cancer and birth defects as well as increased susceptibility to opportunistic

pathogens resulting from damage to the immune system. High quality records and data collection were necessary both to investigate epidemiological questions and to develop solutions to the health problems in the region.[7] Thus, there was a need to establish a cancer registry in order to accomplish three main objectives:

1. Measure changes in cancer morbidity and mortality by monitoring all types of cancer diagnosed and treated in the region.
2. Improve primary and secondary prevention of cancer through programs for early detection and preventative medicine.
3. Develop a comprehensive program of modern cancer care.

In the process of establishing a Cancer Registry Center for the Semey partner hospitals and the region, HSP sparked several unique opportunities. In addition to establishing a number of cancer-related educational opportunities, the partnership allowed Semey oncologists and abstractors to travel to Houston for training in data collection and computerized cancer registry procedures.

Image Description: Sara Rozin working with the head of the Oncology Hospital on the cancer registry software. Image courtesy of Armin Weinberg.

As a result of these vigorous training efforts, HSP developed Kazakhstan's first computerized Cancer Registry Center that met international standards.[8] Sara Rozin worked with bilingual programmers, statisticians, physicians, and cancer registrars to

develop cancer registry software to be bilingual in English and Russian and installed in the Semey Oncodispensary (the main cancer hospital of Semey). Frequent international email communication helped to resolve problems as they arose. Aspects of registry management were specifically tailored to the needs of Semey partners. For instance, the design of abstract forms to collect the necessary patient information was created in conjunction with the Kazakh partners to ensure that special needs would be captured. To ensure the registry would be effective, procedures were developed to confirm that information would be gathered on all cancer patients evaluated in the Semey Oncodispensary, the Oblast Children's Hospital, the Emergency First-Aid Hospital, and remote areas of the Oblast.

2. Infection Control

Nosocomial infections arise after a patient is admitted to the hospital. In addition to the danger they pose to patients, they are an expensive consequence of hospitalization. In Semey, nosocomial infection rates were unacceptably high in healthcare facilities. This problem impacted not only patients but also hospital employees. Addressing high infection rates was especially important in the context of limited economic and medical resources of Semey hospitals.

A major goal of the partnership was therefore to set up infection control programs in all partner hospitals, incorporating essential elements of surveillance, prevention, and control, as outlined by the US Centers for Disease Control and Prevention. Semey healthcare professionals underwent training with TMH Infection Control Team on a variety of infection control topics, including the establishment of periodic quality assurance (QA) programs.

Training in infection control prompted the Semey Nursing Association (SNA) to conduct several infection control seminars for nurses in the Semey region. Further, nurse educators in each partner hospital established an infection control educational program for hospital employees.

3. Clinical Pathology and Laboratory Medicine

Following the collapse of the Soviet Union, the newly independent states had great difficulty in supporting the infrastructure of highly technical industries. Specifically, the highly automated clinical laboratory experienced marked reduction in instrument and reagent support. Hence, many important clinical decisions could no longer be based upon laboratory data but relied solely on clinical judgement. Because Semey was a former nuclear testing area, there was great interest in cancer incidence and proper classification

of tumors for diagnosis, treatment, and academic communication.[9] Notably, because thyroid enlargement was endemic in the region, thyroid cancer was over-diagnosed. Although masses found to be benign by fine needle biopsy can be addressed safely without surgery, surgical excision was commonplace, at great expense and morbidity.

Therefore, one of the goals of the HSP was to aid Semey pathologists by providing equipment. This improved clinical pathology services, diagnosed and treated thyroid dysfunction at an earlier stage, and better identified when thyroid-related surgical procedures were necessary. Partners conducted numerous training programs in both Semey and Houston.[10] Training involved both technique and technology, and trainees received manuals for existing and newly donated equipment. QA programs were established in each partner laboratory, which included Houston Tumor Board conferences and the provision of both computer software and reagents. Further, improvements in screening were implemented through bench instruction in lab sciences that covered the performance and interpretation of special stains to differentiate various types of leukemia. To complement these efforts, new procedures were developed for laboratory safety and blood collection, processing, and storage at the laboratory as well as the patients' bedside.

Following these training experiences, the US Department of Defense (DOD) delivered medical equipment worth $6 million to Semey hospitals that participated in the HSP. Where possible, arrangements were made to supply reagents. The Houston partners also helped develop procedure manuals both for existing equipment and new DOD-provided equipment. These efforts were quickly rewarded because new collaborative research projects were undertaken in the areas of prostate cancer and thyroid cancer detected at autopsy in Kazakhstan.[11] Their findings were presented at national meetings both in the United States and Kazakhstan.

4. Pediatric Leukemia Treatment

A variety of neoplasms, including pediatric Acute Lymphocytic Leukemia (ALL), were prevalent in Semey, possibly an effect of sustained radiation exposure. In Semey, ALL was almost uniformly fatal, although this form of childhood cancer is one of the most treatable in the United States. The need in this area was complicated by the past secrecy of the nuclear testing program, which often forbade the diagnosis of pediatric cases. It was important to educate physicians that ALL could be reported, and to determine if any past data could be recovered. Partnership physicians in Semey and Houston shared the opinion that poor survival was linked to the lack of continued availability of drug therapy, poverty of reasonable treatment approaches, and difficulty in leukemia subtype assignment.

Therefore, one goal of the partnership was to increase survival rates of children with ALL by improving the clinical skills of medical staff and increasing therapeutic options in the partnership hospitals. Training to meet this goal included working with Semey physicians in Houston and Semey as well as via the internet. Visits to Texas Children's Hospital (TCH) were also included to incorporate hands-on training in a number of areas. In addition, two Semey pediatricians came to Houston for month-long training programs in cancer treatment protocols.

As a result of these activities, Semey and Houston physicians worked together to develop bilingual English and Russian treatment protocols, including considerations of the cost of drugs and need for funding support. The United Methodist Church General Board of Global Ministries (GBGM) provided initial funding for medications. To supplement these efforts, GBGM provided $35,000 to support advancements in pediatric leukemia treatment.

5. Healthcare Management, Finance, and Decision-Making

At the time of the partnership, healthcare in Kazakhstan—and Semey in particular—was just beginning to become privatized. There was a need to develop formal programs to manage the development of private medical practice and its integration with governmental health services. Therefore, one goal of this partnership was to develop a model for healthcare reform in Semey, paying special attention to the impacts of privatization.

Training for this program included a number of meetings with healthcare administrators. A senior vice president of TMH traveled to Semey and met with different trainee groups.[12] In Houston, participants including the head of the Semey's Health Department, chief physicians from partner hospitals, and the directors of Semey Medical Academy and Semey Medical College met management staff at different organizational levels, including both administrators and clinical supervisors. A program of instruction was also implemented covering a wide range of management and financial topics. These trainings and the translation of organizational charts and job descriptions better placed Kazakh administrators to navigate an increasingly privatized healthcare market.

6. Disaster Management, Accident Preparedness, and Emergency Care

There were additional active reactor sites in Kurchatov and Pavlodar, farther away from Semey than the primary test site. In addition, the potential for radiation exposure during the conversion of nuclear materials in the Semey Oblast prompted a need for

specialized emergency treatment and evacuation services. Thus, HSP sought to establish a disaster management and emergency medical care program in Semey.

Training included a wide assortment of activities. In Houston, all Semey chief nurses were introduced to hospital safety protocols and safety education procedures. The director of Emergency Medical Services (EMS) and the head of the Disaster Management Faculty at the Semey Medical Academy participated in training programs with the director of Disaster Management for TMH. During these programs, they observed and evaluated many aspects of emergency care and equipment that could be used in Semey, which included the following: two pre-hospital care models, three emergency room models of patient care, aeromedical operations and communications centers for two EMS helicopter programs, commercial nuclear power reactor emergency response and medical support programs (with an emphasis on how government aids in disaster preparedness), disaster response capabilities at a local hospital directly responsible for responding to radiation emergencies, Texas Department of Public Safety emergency response plans, relations among hospitals through the National Disaster Medical System coordinated by Veterans Administration hospitals for regional response, and city and county disaster planning through a command center.

7. Continuing Nurse Education

At the time of the partnership in the Semey healthcare system, the role of the nurse was very limited. Nurses were relegated to the lower end of professional activity without a direct role in patient care. With the move toward privatization and a free market economy, there was an opportunity to expand nurses' roles in the new healthcare system and improve their professional status. Our goal of continuing nurse education was to produce better patient care outcomes by developing nursing leadership, functions, and standards of practice, and by improving recognition of nursing. These goals were subdivided into the immediate aims of increased teamwork between nurses and physicians in partner hospitals, more independent roles for nurses in the healthcare system, and the creation of an established system for continuing nurse education and professional development.

In addition to exchanges between Semey and Houston, Semey nurses attended training programs sponsored by TMH in Houston, Semey, and Istanbul. Working with nursing leaders in Semey, each partner hospital developed a model intensive care unit, emphasizing leadership skills, clinical practice, education, infection control, and safety management. The partnership hospitals developed the role of clinical educator, who was responsible for orienting new employees as well as providing continuing nursing education and other areas of professional staff development. The SNA was established

and grew to more than 2,000 members in the Semey Region, forming a partnership with the American Association of Operating Room Nurses (AORN) to promote the basis for professional nursing standards in Semey. This partnership came to fruition when Counterpart International (formerly Counterpart Organization) approved a grant application submitted jointly by the SNA and AORN to support the First and Second International Nursing Conferences. The executive director of AORN participated in both conferences, which were held in Semey. The SNA established a learning resource center and a nurse continuing education program providing facilities for learning clinical skills, such as cardiopulmonary resuscitation, wound dressing changes using aseptic technique, and other essential medical skills.

Image Description: Nurses attending a lecture during a nursing education conference. Image courtesy of Armin Weinberg.

8. Continuing Medical Education

Medical staff from Semey needed follow-ups and reinforcement of the knowledge and skills that they learned through the partnership. Furthermore, they had responsibility for introducing and conveying to their colleagues what they had learned. Therefore, HSP set a goal to establish a regular program of continuing education conferences for medical staff at the partner hospitals in Semey.

In addition to Semey physicians coming to Houston for extended training programs, the Houston partners also conducted numerous conferences and training programs in Semey for medical staff at the partner hospitals. Further, the partnership conducted semiannual continuing medical education programs for medical staff at the partnership hospitals in Semey. At Semey Medical Academy and Semey Medical College, BCM and University of Texas Health Science Center (UTHSC) faculty members conducted master teacher training programs on current concepts in teaching techniques and student evaluation.

9. Public Health Education and Preventive Medicine

In Semey, there were a number of public health problems that needed to be addressed, including infection control, diet and nutrition, general hygiene, early prenatal care, smoking, and alcoholism. By consequence, a goal of the partnership was to increase public health and health education initiatives and improve the success rates for programs in areas targeted by health professionals in Semey.

During their training programs, Semey physician and nurse educators were introduced to public, community, and worksite health initiatives. In Houston, these included preventive medicine programs at TMH, the Department of Family Practice and Community Medicine at BCM, public health and health education initiatives at the UTHSC Schools of Public Health and of Nursing, as well as programs of the Houston health department and HCHD. Because education is an important component of professional nursing, the partnership nursing education programs included a wide variety of components related to patient education and public health education. For instance, the chief nurse of the Semey Oncodispensary was introduced to cancer prevention programs at BCM Medicine and the University of Texas MD Anderson Cancer Center. In the SNA Learning Resource Center, nurses learned how to teach breast self-examination.

Further, for the general public, a BCM faculty educator gave a presentation on smoking cessation techniques to the medical staff of the addiction treatment clinic in Semey. He was also interviewed on local television. The Santa Fe Gold Corporation (now Newmont Mining Corporation) provided funding for the Semey Prevention Center and other public health initiatives, such as the production of television programming and newspaper supplements related to preventive medicine. GBGM also sponsored a visit to Texas for the Governor of the Semey Region and provided $15,000 for pilot research on the effects of nuclear testing in the region.

Key Impacts of Partnership Synergy

Simply listing the exchange visits does not describe the breadth and depth of HSP initiatives beyond those specified in the original partnership agreement. Examples of accomplishments beyond the original partnership agreements included the following:

- By the early 1990s, The Methodist Hospital had collaborated with the American Hospital of Istanbul, Turkey. The partnership arranged for training of thirteen Semey physicians and nurses at the American Hospital in Istanbul.
- The Houston partners hosted a Semey surgeon who received a US Department of Commerce Special American Business Internship Training Program (SABIT) Fellowship to learn about new technologies and innovative management skills necessary to support transition to free market economies. The fellow focused his training on hospital and healthcare administration.
- The Houston partners hosted a Semey physician who received an International Atomic Energy Agency Fellowship to obtain practical, guided, on-the-job training related to the effects of nuclear energy on medicine and the environment.
- As a result of partnership initiatives, AmeriCares provided several shipments of pharmaceuticals worth approximately $2,500,000, delivered with the assistance of the US Department of State.
- The US DOD delivered surplus medical equipment worth $6,000,000 to partnership hospitals.
- Cosponsored by the partnership together with the Kazakhstan National Nuclear Center, Ministry of Science and New Technology, and the Regional Administration, a workshop on Health Effects of Environmental Radiation Exposure in Kazakhstan was conducted in Kurchatov.
- Telemedicine linkages were established among the partner institutions.
- The partnership was among those selected to host a study tour for management level physicians from Kazakhstan, Kyrgyzstan, and Uzbekistan, in conjunction with health reform initiatives in Central Asia. The tour was funded by USAID through Abt Associates, the Academy for Educational Development, and AIHA.

While this case study emphasizes how Semey benefited from collaborations with Houston, US partners also benefitted greatly from partnership activities. Specifically,

- Challenges faced when working with Kazakhstan colleagues caused Houston partners to reexamine the basic premises of our own systems.
- There was an unprecedented opportunity for beginning important scientific investigations and collaborations concerning the health effects of radiation.

- International exchange and regular email communication between the partners set the foundation for institutional and community linkages and enabled continuity among relationships.

The partnership employed many approaches to connect across institutional, organizational, and national boundaries to aid in the aftermath of the Soviet Union's collapse. In doing so, nine goals were jointly identified, and benefits were felt in both directions. Considering the newly growing recognition of the need for sustained partnerships investigating effects of low-dose radiation, and the importance of close interaction between government and science, the partnership's prescient emphasis on science diplomacy had far-reaching effects. Unfortunately, after 1999, there were limited funds by which to continue collaboration. Despite the lack of funds, HSP's strong, interpersonal connections persisted, as Kazakh partners reached out to ask how Houston partners were faring following the attacks of September 11, 2001. These relationships would have augmented the success of continued programming had sustained collaboration been prioritized. Hence, we suggest that future public health programs place paramount importance on continued engagement, and that funding agencies realize the crucial need for prolonged involvement to advance science diplomacy.

Image Description: Meeting of HPS leadership across Texas hospitals with George W. Bush, who was then governor of Texas. Image courtesy of Armin Weinberg.

Discussion

By the formal end of project activities, the HSP had grown into an international program of medical, scientific, and socioeconomic exchange. Over this period, sixty-one Semey physicians and nurses were trained in Houston, and forty-nine Houston physicians, nurses, and other faculty conducted training programs in Semey. In addition, the partnership translated over fifty documents, including medical guidelines and training materials into Russian following the various program goals. To better serve the people of Kazakhstan in a period of market reform and privatization, partnership activities were guided by an effort to build linkages among healthcare providers across both academic and clinical settings, the government, which has ultimate responsibility for healthcare in Kazakhstan, and the business sector. On these counts, the partnership succeeded, as evidenced by the many achievements indicated in Figure 1.

Limitations

This community case study was compiled retrospectively, by sifting through documentation and personal recollections preserved from the original Houston-Semipalatinsk collaboration notes taken almost thirty years ago. Many of these materials are now preserved in the Archives of the Texas Medical Center Library McGovern Historical Center.[13] While unique insights can be gleaned from this analysis, including how these interventions impacted development until the present, it is important to note that the descriptions of developments in Kazakhstan only detail changes made before the closure of program activities. Further, healthcare development and progress does not have standard evaluation metrics, so comparisons were made with healthcare in Houston, Texas, as a frame of reference. Houston was selected because the Texas Medical Center partners were well-versed in healthcare practices and followed a very high-quality standard of healthcare. This was a necessary but inherent methodological limitation; assessing the many present-day outgrowths of this partnership suggests that the limitation had minimal impact on the benefit of the partnership.

Table 1. Houston-Semipalatinsk Healthcare Partnership: Institutions and Partnership Roles

Organization/Institution	Role in Partnership
United Methodist General Board of Global Ministries/ United Methodist Committee on Relief (GBBM/UMCOR) https://umcmission.org/umcor/	Key funding sponsor
American International Health Alliance (AIHA) https://www.aiha.com/project-archive/	Key funding sponsor
US Agency for International Development (USAID) https://www.usaid.gov/kazakhstan	Cooperative agreement with AIHA for funding support
The Methodist Hospital Houston (TMH) (Now: Houston Methodist Hospital) https://www.houstonmethodist.org/	Key partner for infection control, healthcare administration, disaster management, nursing training, and preventative and family medicine programs
Baylor College of Medicine (BCM) https://www.bcm.edu/	Key partner for medical teaching, family practice, community medicine, cancer prevention, and public health programs
University of Texas Health Science Center (UTHSC) https://www.uth.edu	Partner for medical teaching, public health, and nursing programs
Michael E. DeBakey Veterans Medical Center (MEDVAMC) https://www.va.gov/houston-health-care/locations/michael-e-debakey-department-of-veterans-affairs-medical-center/	Provided faculty for nursing training
Defense Threat Reduction Agency (DTRA) https://www.dtra.mil/	Agency for US government support of remediation efforts in Semipalatinsk
Texas Children's Hospital (TCH) https://www.texaschildrens.org/	Partner for hands-on training in hematology/oncology, pediatric surgery, radiotherapy, pathology, and phlebotomy services
University of Texas M.D. Anderson Cancer Center (UTMDACC) https://www.mdanderson.org/	Partner for hands-on training in cancer prevention
Harris County Hospital District (Now: Harris Health System) https://www.harrishealth.org/about-us/harris-health	Partner for hands-on training in public health education and preventative medicine
Oblast Oncodispensary (Now: Center for Nuclear Medicine and Oncology of Semey") (CNMES) https://semeyonco.kz/	Primary cancer hospital of Semipalatinsk

Organization/Institution	**Role in Partnership**
Oblast Children's Hospital (Now: Pediatric Department of University Hospital of NCJSC "Semey Medical University") https://medcentr.gmu.kz/	Pediatric department of Semey Medical University Hospital
Emergency First-Aid Hospital http://bsmpsemey.kz/	Emergency hospital of Semipalatinsk
Oblast Clinical Hospital (Now: University Hospital of NCJSC "Semey Medical University") https://medcentr.gmu.kz/	University Hospital for NCJSC "Semey Medical University"
Oblast Diagnostic Treatment Center (Now: Family Outpatient Clinic No.7 of Semey) https://diagnose.kz/	Family outpatient clinic in Semipalatinsk
Semipalatinsk Gynecological Hospital (Now: Zhamilya Gynecological Clinic) http://jamilay.kz/	Gynecological hospital of Semipalatinsk
Semipalatinsk Medical Academy (Now: NCJSC "Semey Medical University") http://semeymedicaluniversity.kz	Institute to train physicians in Semipalatinsk
Semipalatinsk Medical College (Now: Kalmatayev State Higher Medical College of Semey) https://gsmk.edu.kz/	Institute to train nurses in Semipalatinsk

Table 2. Houston-Semipalatinsk Healthcare Partnership: Impact on Various Partnership Activity Areas

1. Cancer registry development and improved screening	2. Improved nosocomial infection control and surveillance	3. Advancements in clinical pathology services
• Cancer registry procedures lecture series in Semipalatinsk • Training in Houston for oncologists and abstractors for registry management, abstracting, coding, staging, treatment, follow-up, and quality management • Semipalatinsk pathologists trained in registry and abstracting forms • Developed Kazakhstan's first computerized cancer registry, bilingual English/Russian • Abstract forms designed to collect data tailored to the needs of Kazakh partners • Procedures developed for use of registry	• Semipalatinsk healthcare professionals trained with TMH infection control team on surveillance, policies, disinfection measures, and periodic evaluations • Ordered a laminator for infection control signs • SNA conducted infection control seminars • Semipalatinsk nurse educators established a hospital infection control education program	• TMH and BCM pathologists conducted training programs in Semipalatinsk for thyroid diseases • Semipalatinsk pathologists attended four-week training program in Houston • QA programs implemented, including providing computer software and reagents • Performance of fine needle aspiration biopsy and immunohistochemistry for thyroid disease screening • DOD delivered $6 million worth of medical equipment • Collaborative research in prostate and thyroid cancer conducted and presented at national meetings

4. Improved outcomes for pediatric leukemia patients	5. Instruction in healthcare management, finance, and administration	6. Training for disaster management, emergency care, and incident planning
• Semipalatinsk medical staff visited TCH in Houston for hands-on training in inpatient and outpatient hematology/oncology, pediatric surgery, radiotherapy, pathology, and phlebotomy services • Semipalatinsk pediatricians visited Houston for a month-long training program in cancer treatment • Partners jointly developed two bilingual English/Russian treatment protocols, also considering cost assessment for drugs and support • GBGM provided $35,000 support for studies on pediatric leukemia • GBGM delivered medication to treat seven pediatric leukemia patients following the revised protocol	• TMH senior vice president met trainee groups in Semipalatinsk • Semipalatinsk trainees, including the head of the Health Department, chief physicians, and directors of the Semey Medical Academy and Semey Medical College, visited Houston and met both administrative staff and clinical supervisors • Program of instruction implemented including teaching hospital management, financial budgeting, managed care, healthcare strategic planning, insurance, managed care, and physician funding • Organizational charts and job descriptions translated	• Semipalatinsk Chief Nurses introduced to Houston hospital safety and safety education procedures • Head of Disaster Management and director of Emergency Medical Services participated in training programs with TMH Director of Disaster Management about equipment, models of patient care, and government relationship to emergency response at the city, county, state, and federal levels • The Tucson-Almaty EMS Partnership through AIHA supplemented preparedness efforts by providing additional training for Semipalatinsk medical professionals

7. Establishment of a continuing nurse education program	8. Improvements to the continuing physician education program	9. Augmentation of public health education and preventative medicine programming
• Semipalatinsk nurses attended training programs conducted locally, in Houston by TMH, and in Istanbul, Turkey • UTHSC School of Nursing Associate Dean and BCM Education Specialist assessed the curriculum and conducted master teacher classes for the Semipalatinsk Medical College • SNA was developed in partnership with AORN and international nursing conferences resulted • Developed model ICU departments, the role of clinical educator, and programs in continuing nurse education	• Established a regular program of continuing education conferences for medical staff in Semipalatinsk • Semipalatinsk physicians visited Houston for extended and specialized training • Houston physicians traveled to Semipalatinsk to conduct semiannual continuing medical education programs and master teacher training programs for concepts in teaching techniques and student evaluation	• Semipalatinsk physician and nurse educators introduced to preventative medicine programs in Houston conducted through TMH, BCM, UT Schools of Public Health and Nursing, Houston health department, and HCHD • Chief nurse of Oncodispensary introduced to cancer prevention programs at BCM and MDACC • BCM faculty educator presented on smoking cessation techniques at Semipalatinsk addiction treatment clinic, and interviewed on local television • Television and newspaper programs on preventative medicine • GBGM provided $15,000 to support pilot research on effects of nuclear testing

Notes

[1] Wudan Yan, "The Nuclear Sings of the Soviet Union Live on in Kazahstan," News Feature, *Nature* 568 (April 4, 2019): 22–4, https://www.nature.com/articles/d41586-019-01034-8. See Nuclear Threat Initiative, "Semipalatinsk Test Site," *NTI (Nuclear Threat Initiative)*, last modified October 24, 2021, https://www.nti.org/education-center/facilities/semipalatinsk-test-site/; RFE/RL's Kazakh Service, "Thirty Years Ago, Kazakhstan Closed Soviet-Era Nuclear Test Site," *Radio Free Europe/ Radio Liberty*, August 29, 2021, https://www.rferl.org/a/semipalatinsk-nuclear-test-kazakhstan/31433543.html.; K. Johnson, "The Polygon: Former Soviet Union Nuclear Test Site on Kazakh Steppe Now Open for Tours," *ABC News (Australia)*, last modified August 13, 2015, https://www.abc.net.au/news/2015-08-13/the-polygon-a-nuclear-guide-to-the-kazakhstan-steppe/6694834; Yan, "Has Kazakhstan Forgotten about Its Polygon Test Survivors?," *The World*, December 18, 2018, https://theworld.org/stories/2018-12-19/has-kazakhstan-forgotten-about-its-polygon-test-survivors; and Bec Crew, "Russia Covered Up a Nuclear Fallout Worse Than Chernobyl, Confidential Report Reveals," *ScienceAlert*, March 27, 2017, https://www.sciencealert.com/russia-covered-up-a-nuclear-fallout-worse-than-chernobyl-confidential-report-reveals.

[2] Defense Threat Reduction Agency, Project Sapphire After Action Report" (November 1994), *The National Security Archive*, accessed June 24, 2022, https://nsarchive2.gwu.edu/NSAEBB/NSAEBB491/docs/01%20-%20After%20Action%20report%20DTRA.pdf.

[3] Leif E. Peterson and Armin D. Weinberg, "Proposal for Health Effects Studies Related to Nuclear Weapon Testing at Semipalatinsk, Kazakhstan; Predlozhenie Po Izucheniyu Vliyaniya Na Zdorov`e Ispytanij Yadernogo Oruzhiya v Semipalatinske, Kazakstan" (conference presentation, International Conference on Non-Proliferation Problems, Almaty-Kurchatov, Kazakhstan, September 8–12, 1997), https://www.osti.gov/etdeweb/biblio/618585; Togzhan Kassenova, "Living with the Nuclear Tests: The Semipalatinsk Story," *CTBTO Spectrum* 25 (July 2020): 27–9, https://www.ctbto.org/sites/default/files/2022-08/00_025_spectrum_july_2020_web.pdf.

[4] United Nations Secretary-General, "International Cooperation and Coordination for the Human and Ecological Rehabilitation and Economic Development of the Semipalatinsk Region of Kazakhstan: Report of the Secretary-General," *United Nations Digital Library*, September 23, 1998, https://digitallibrary.un.org/record/262148; United Nations General

Assembly, "Resolutions Adopted by the General Assembly," Fifty-Second Session, Agenda Item 20 (b), February 20, 1998, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N98/766/51/PDF/N9876651.pdf?OpenElement; and Ministry of Foreign Affairs of Japan, "The Tokyo International Conference on Semipalatinsk, 6–7 September 1999," accessed June 24, 2022, https://www.mofa.go.jp/region/europe/kazakhstan/semipala/summary9909.html.

[5] American Association for the Advancement of Science, "Center for Science Diplomacy," accessed June 24, 2022, https://www.aaas.org/programs/center-science-diplomacy.

[6] Mary Helen Barcellos-Hoff et al., "Low-Dose Radiation Knowledge Worth the Cost," Letters to the Editor, *Science* 332, no. 6027 (April 2011): 305–6; Kazuo Sakai et al., "Conclusions and Suggestions on Low-Dose and Low-Dose Rate Radiation Risk Estimation Methodology," *Journal of Radiation Protection and Research* 46, no. 1 (March 2021): 14–23; Subcommittee on Physical Sciences of the National Science and Technology Council, "Radiation Biology: A Response to the American Innovation and Competitiveness Act," January 2022, https://www.whitehouse.gov/ostp/news-updates/2022/01/31/nstc-radiation-biology-a-response-to-the-american-innovation-and-competitiveness-act/; and National Academies of Sciences, Engineering, and Medicine, *Leveraging Advances in Modern Science to Revitalize Low-Dose Radiation Research in the United States* (Washington, DC: National Academies Press, 2022), https://nap.nationalacademies.org/catalog/26434/leveraging-advances-in-modern-science-to-revitalize-low-dose-radiation-research-in-the-united-states.

[7] Irina V. Volguina, "Descriptive Epidemiology of Cancer in Three Regions of Kazakhstan" (PhD diss., The University of Texas School of Public Health, 2001), https://digitalcommons.library.tmc.edu/dissertations/AAI1416259/.

[8] Teresa G. Hayes et al., "Establishment of a Cancer Registry in Semipalatinsk, Kazakhstan," *Journal of Registry Management* 27, no. 1 (January 2000): 15–9.

[9] Vladimir Drozdovitch et al., "Behavior and Food Consumption Pattern of the Population Exposed in 1949-1962 to Fallout from Semipalatinsk Nuclear Test Site in Kazakhstan," *Radiation and Environmental Biophysics* 50, no. 1 (March 2011): 91–103; Charles E. Land et al., "Accounting for Shared and Unshared Dosimetric Uncertainties in the Dose Response for Ultrasound-Detected Thyroid Nodules after Exposure to Radioactive Fallout," *Radiation Research* 183, no. 2 (February 2015): 159–73.

[10] Thomas M. Wheeler, "Tom Wheeler Video Interview," interviewed by Sachi Khemka, *An Initial Overview of Radiation*, Rice Fondren Library: Rice Research Repository, November 22, 2020, https://hdl.handle.net/1911/109662.

[11] Yuri Pruglo, Wheeler, and M. Yu Barakat, "Inflammation and Latent Prostate Cancer," in "XXVI Congress of the IAP: Abstracts," *Modern Pathology* 19, supplement 3 (September 2006): 87; Peterson et al., "Diagnosis of Benign and Malignant Thyroid Disease in the East Kazakhstan Region of the Republic of Kazakhstan: A Case Review of Pathological Findings for 2525 Patients," *Cancer Research, Therapy, and Control* 5, no. 4 (1998): 307–12; and Land et al., "Ultrasound-Detected Thyroid Nodule Prevalence and Radiation Dose from Fallout," *Radiation Research* 169, no. 4 (April 2008): 373–83.

[12] Randy Wright, "Randy Wright Video Interview," interviewed by Sachi Khemka, *An Initial Overview of Radiation*, Rice Fondren Library: Rice Research Repository, November 9, 2020, https://hdl.handle.net/1911/109656.

[13] Weinberg, "Armin Weinberg, PhD Papers," MS 211, McGovern Historical Center, Texas Medical Center Library, Houston, TX.

Author Bios

Rishi Shridharan is a MD/PhD student at Perelman School of Medicine at the University of Pennsylvania. Rishi first grew interested in research at the Texas Academy of Math and Science, where his study of glial cells in the brain was recognized with the Goldwater Scholarship. While pursuing a BA in neuroscience at Rice University, he worked in a human genetics lab to diagnose rare pediatric diseases as well as a synthetic biology lab to design tools against antibiotic resistance. Alongside basic science, he had the privilege of learning from Drs. Armin Weinberg and Melissa Bailar as part of the medical humanities minor. Following his graduation, Rishi spent nine months in Belgium on a Fulbright Research Fellowship, characterizing and optimizing a light-based gene expression system.

During the Houston-Semipalatinsk Healthcare Partnership, Larry Laufman, EdD, was Assistant Director for Educational Development in the Center for Chronic Disease Research and Control at Baylor College of Medicine. He is currently Associate Professor in the Department of Medicine and the Center for Medical Ethics and Health Policy at Baylor.

During the Houston-Semipalatinsk Healthcare Partnership, Sara Rozin, MS, was Coordinator of International Programs in the Center for Chronic Disease Research and Control at Baylor College of Medicine. She is currently Founder and Owner of Houston Health Concierge in Houston, Texas. The company helps facilitate the healthcare needs of patients both from the USA and internationally.

Armin Weinberg is a Clinical Professor at Baylor College of Medicine. Dr. Weinberg spearheaded international partnerships in the Ukraine, Kazakhstan, Russia, and Israel on the health effects of radiation. He is currently also an Adjunct Professor at Rice University where he mentors students in the medical humanities program, helping build archives related to his work in both radiation effects and events as well as cancer health disparities.

Funding Statement
No external funding was received for the course or this article.

Conflicts of Interest Statement
The authors have no competing interests to declare.

References

American Association for the Advancement of Science. "Center for Science Diplomacy." https://www.aaas.org/programs/center-science-diplomacy.

Barcellos-Hoff, Mary Helen, David J. Brenner, Antone L. Brooks, et al. "Low-Dose Radiation Knowledge Worth the Cost." Letters to the Editor. *Science* 332, no. 6027 (April 2011): 305–6.

Crew, Bec. "Russia Covered Up a Nuclear Fallout Worse Than Chernobyl, Confidential Report Reveals." *ScienceAlert*. March 27, 2017. https://www.sciencealert.com/russia-covered-up-a-nuclear-fallout-worse-than-chernobyl-confidential-report-reveals.

Drozdovitch, Vladimir, Sara Schonfeld, Kuat Akimzhanov, et al., "Behavior and Food Consumption Pattern of the Population Exposed in 1949-1962 to Fallout from Semipalatinsk Nuclear Test Site in Kazakhstan." *Radiation and Environmental Biophysics* 50, no. 1 (March 2011): 91–103.

Defense Threat Reduction Agency, Project Sapphire After Action Report" (November 1994). *The National Security Archive*. https://nsarchive2.gwu.edu/NSAEBB/NSAEBB491/docs/01%20-%20After%20Action%20report%20DTRA.pdf.

Hayes, Teresa G., Sara Rozin, Irina V. Volguina, et al., "Establishment of a Cancer Registry in Semipalatinsk, Kazakhstan." *Journal of Registry Management* 27, no. 1 (January 2000): 15–9.

Johnson, K. "The Polygon: Former Soviet Union Nuclear Test Site on Kazakh Steppe Now Open for Tours." *ABC News (Australia)*. Last modified August 13, 2015. https://www.abc.net.au/news/2015-08-13/the-polygon-a-nuclear-guide-to-the-kazakhstan-steppe/6694834;

Kassenova, Togzhan. "Living with the Nuclear Tests: The Semipalatinsk Story." *CTBTO Spectrum* 25 (July 2020): 27–9. https://www.ctbto.org/sites/default/files/2022-08/00_025_spectrum_july_2020_web.pdf.

Land, Charles E., Zhaksibay S. H. Zhumadilov, Boris I. Gusev, et al. "Ultrasound-Detected Thyroid Nodule Prevalence and Radiation Dose from Fallout." *Radiation* Research 169, no. 4 (April 2008): 373–83.

Land, Charles E., Deukwoo Kwon, F. Owen Hoffman, et al. "Accounting for Shared and Unshared Dosimetric Uncertainties in the Dose Response for Ultrasound-Detected Thyroid Nodules after Exposure to Radioactive Fallout." *Radiation Research* 183, no. 2 (February 2015): 159–73.

Ministry of Foreign Affairs of Japan. "The Tokyo International Conference on Semipalatinsk, 6–7 September 1999." https://www.mofa.go.jp/region/europe/kazakhstan/semipala/summary9909.html.

National Academies of Sciences, Engineering, and Medicine. *Leveraging Advances in Modern Science to Revitalize Low-Dose Radiation Research in the United States*. Washington, DC: National Academies Press, 2022. https://nap.nationalacademies.org/catalog/26434/leveraging-advances-in-modern-science-to-revitalize-low-dose-radiation-research-in-the-united-states.

Nuclear Threat Initiative. "Semipalatinsk Test Site." *NTI (Nuclear Threat Initiative)*. Last modified October 24, 2021. https://www.nti.org/education-center/facilities/semipalatinsk-test-site/.

Peterson, Leif E., and Armin D. Weinberg, "Proposal for Health Effects Studies Related to Nuclear Weapon Testing at Semipalatinsk, Kazakhstan; Predlozhenie Po Izucheniyu Vliyaniya Na Zdorov`e Ispytanij Yadernogo Oruzhiya v Semipalatinske, Kazakstan. Conference Presentation. International Conference on

Non-Proliferation Problems, Almaty-Kurchatov, Kazakhstan, September 8–12, 1997. https://www.osti.gov/etdeweb/biblio/618585.

Peterson, Leif E., Zhaksibay S. H. Zhumadilov, Sunil Kripalani, et al. "Diagnosis of Benign and Malignant Thyroid Disease in the East Kazakhstan Region of the Republic of Kazakhstan: A Case Review of Pathological Findings for 2525 Patients." *Cancer Research, Therapy, and Control* 5, no. 4 (1998): 307–12.

Pruglo, Yuri, Thomas M. Wheeler, and M. Yu Barakat, "Inflammation and Latent Prostate Cancer," in "XXVI Congress of the IAP: Abstracts." *Modern Pathology* 19, supplement 3 (September 2006): 87.

RFE/RL's Kazakh Service. "Thirty Years Ago, Kazakhstan Closed Soviet-Era Nuclear Test Site." *Radio Free Europe/ Radio Liberty*. August 29, 2021. https://www.rferl.org/a/semipalatinsk-nuclear-test-kazakhstan/31433543.html.

Sakai, Kazuo, Yutaka Yamada, Kazuo Yoshida, et al. "Conclusions and Suggestions on Low-Dose and Low-Dose Rate Radiation Risk Estimation Methodology." *Journal of Radiation Protection and Research* 46, no. 1 (March 2021): 14–23.

Subcommittee on Physical Sciences of the National Science and Technology Council. "Radiation Biology: A Response to the American Innovation and Competitiveness Act." January 2022. https://www.whitehouse.gov/ostp/news-updates/2022/01/31/nstc-radiation-biology-a-response-to-the-american-innovation-and-competitiveness-act/.

United Nations General Assembly. "Resolutions Adopted by the General Assembly." Fifty-Second Session, Agenda Item 20 (b). February 20, 1998. https://documents-dds-ny.un.org/doc/UNDOC/GEN/N98/766/51/PDF/N9876651.pdf?OpenElement.

United Nations Secretary-General. "International Cooperation and Coordination for the Human and Ecological Rehabilitation and Economic Development of the Semipalatinsk Region of Kazakhstan: Report of the Secretary-General." *United Nations Digital Library*. September 23, 1998. https://digitallibrary.un.org/record/262148.

Volguina, Irina V. "Descriptive Epidemiology of Cancer in Three Regions of Kazakhstan." PhD diss., The University of Texas School of Public Health, 2001. ProQuest (AAI1416259).

Weinberg, Armin D. "Armin Weinberg, PhD Papers." MS 211. McGovern Historical Center, Texas Medical Center Library, Houston, TX.

Wheeler, Thomas M. "Tom Wheeler Video Interview." Interviewed by Sachi Khemka. *An Initial Overview of Radiation*. Rice Fondren Library: Rice Research Repository, November 22, 2020. https://hdl.handle.net/1911/109662.

Wright, Randy. "Randy Wright Video Interview." Interviewed by Sachi Khemka. *An Initial Overview of Radiation*. Rice Fondren Library: Rice Research Repository, November 9, 2020. https://hdl.handle.net/1911/109656.

Yan, Wuhan. "Has Kazakhstan Forgotten about Its Polygon Test Survivors?" *The World*, December 18, 2018. https://theworld.org/stories/2018-12-19/has-kazakhstan-forgotten-about-its-polygon-test-survivors;

———. "The Nuclear Sings of the Soviet Union Live on in Kazahstan." News Feature. *Nature* 568 (April 4, 2019): 22–4.