

Perspective

Geographical Impact of Human Gift Registries in West Virginia: A Model for Centralized Resources in Human Anatomy Education

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Abstract: The West Virginia State Anatomical Board oversees three Human Gift Registries, which allocate human whole-body donations to support educational, outreach, and research missions in higher education. These Human Gift Registries primarily function to meet the demand for anatomy education at the institutions that house them. Two of these Human Gift Registries, however, demonstrate a unique centralized model, in which approximately half of the donors are reallocated to other institutions to support their missions, and thus, have a geographical impact beyond West Virginia alone. In this perspective, the number of donations received at West Virginia Human Gift Registries over the past seven years are reported by institution, as well as the geographical distribution of donors over the past five years. The report also discusses the impact of the COVID-19 pandemic on human anatomy education. This model of centralized Human Gift Registries in West Virginia may be of interest to other State Anatomical Boards, as well as the families of past, current, and prospective donors in West Virginia. The state of West Virginia remains committed to dissection-based human anatomy education. We are forever grateful to our donors who make this experience possible.

Keywords: human gift registry; anatomy education; donors; dissection; COVID-19

Introduction

A Human Gift Registry (HGR) is an organization responsible for human body donations following death to support the educational, outreach, and research missions of a university. The primary purpose of a HGR is to provide hands-on human anatomy education for students entering allied health professions, including medicine, dentistry, physician assistant, pathologists' assistant, physical therapy, occupational therapy, athletic training, nursing, and pharmacy as well as undergraduate student populations such as general biology, exercise physiology, and anthropology. Exposure to dissection-based human gross anatomy provides students with specialized motor skills and advanced anatomical knowledge that, in turn, may lead to a more profound understanding of human structure (Marks, 2000; Zdilla, 2020). Human gross

anatomy also can help to develop a humanitarian component of student training. Accordingly, our donors are treated with the utmost respect in the anatomy lab (Escobar-Poni & Poni, 2006). In addition to education, human gifts may serve as the basis for anatomical research and scientific discoveries, which may include the identification of novel clinically-relevant anatomical variations (Zdilla et al., 2015; Zdilla et al., 2019), and the refinement of surgical techniques and surgical training (Chung et al., 2020; Grabo et al., 2020; McClelland et al., 2021; Zdilla, 2014; Zdilla & Balta, 2023). This report outlines the status of HGRs in the state of West Virginia in 2023, with an emphasis on our geographical impact and our response to the COVID-19 pandemic. We posit that the HGRs in West Virginia may serve as a model for other institutions, nationally and globally, to centralize resources in human anatomy education, particularly in rural areas.

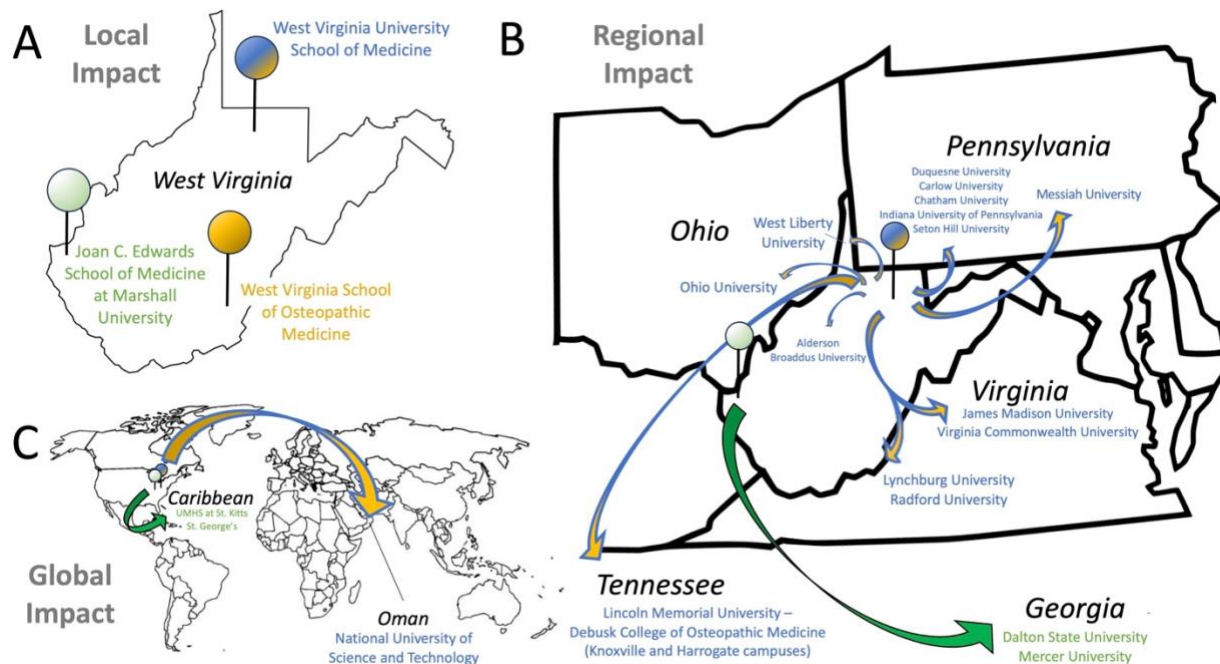


Figure 1. Geographic Impact of Human Gift Registries in West Virginia: A) Local Impact: Institutions within the state of West Virginia with a Human Gift Registry include West Virginia University, Marshall University, and West Virginia School of Osteopathic Medicine. These registries are responsible for managing whole-body donations for the purpose of anatomical education, research, and outreach. B) Regional Impact: Human Gift Registries at West Virginia University and Marshall University supply donors to in-state and out-of-state institutions to help meet educational needs. In addition to greater Pittsburgh area schools, Lincoln Memorial University in Tennessee represents one of WVU’s largest collaborations. In recent years, Marshall has established donation programs with several schools in Georgia. C) International Impact: Human Gift Registries at both West Virginia University and Marshall University supply donors to institutions internationally. West Virginia University has a longstanding partnership with the National University of Science and Technology in Sohar, Oman, while the Marshall University has a strong presence in the Caribbean, supplying University of Medical and Health Sciences in St. Kitts and St. George’s University with whole-body donations.

Human Gift Registries in West Virginia

General Operations

There are three HGRs in the state of West Virginia, each of which is associated with one of three medical institutions in the state. These HGRs are housed at West Virginia University School of Medicine (WVU) in Morgantown, the Joan C. Edwards School of Medicine at Marshall University in Huntington, and at West Virginia School of Osteopathic Medicine (WVSOM) in Lewisburg (Figure 1A). West Virginia HGRs are governed by the West Virginia State Anatomical Board, which is comprised of at least one Dean from each institution to oversee rules and regulations of the registries.

West Virginia is a small, rural state with numerous socioeconomic barriers. Through these three HGRs, however, the state can provide high quality dissection-based anatomy education to future health professionals throughout the state. Furthermore, two of three HGRs

have an impact that is far beyond West Virginia alone. Many human donors from WVU and Marshall are provided to other institutions to help meet the needs of their human anatomy instruction (Figure 1B and 1C). Upon completion of study, these donors are returned to the home institution so that the remains can be cremated and returned to designated family.

In this manuscript, “local impact” is defined as the use of donors within the institution that houses the HGR, “regional impact” is defined as the use of donors in other universities in West Virginia or its surrounding states, and “global impact” is defined as the use of donors internationally (Figure 1). The number of donations per university over the past seven years (Figure 2) as well as donor allocation over the past five years (Figure 3) are reported.

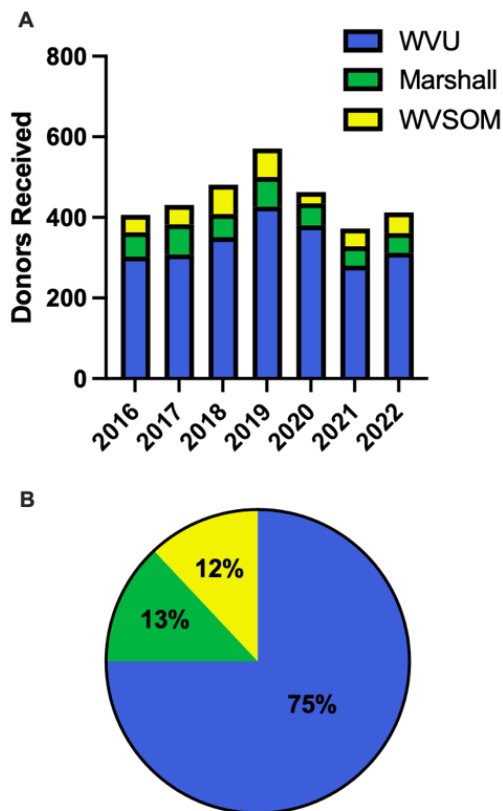


Figure 2. Whole-Body Donation by Institution within West Virginia Human Gift Registries. A) Annual trends of donors received in West Virginia HGRs between 2016 and 2022, color-coded by institution: West Virginia University (WVU) in blue, Marshall University in green, West Virginia School of Osteopathic Medicine (WVSOM) in yellow. The decline in 2020 and 2021 corresponds with the COVID-19 pandemic. B) Seven-year average of donation by institution, demonstrating that most donations go to WVU in Morgantown, while a similar number of donations are processed at Marshall University in Huntington, or at WVSOM in Lewisburg.

Geographic Impact of Human Gift Registry at West Virginia University

Over the past seven years, the three HGRs have collectively received approximately 450 total donations per year. WVU has received 75% of these donations, an average of 337 donors per year (Figure 2). Roughly one half of the donations received at WVU supplement programs internally at WVU’s Morgantown campuses (Figure 3A). These programs include professional programs in medicine, dentistry, physician assistant studies, pathologists’ assistant studies, physical therapy, occupational therapy, athletic training, and pharmacy. Moreover, these donations supplement undergraduate curricula in nursing and exercise physiology. Most of these programs are dissection-based, in which students perform the dissection, while

others are prosection-based, in which the students learn from previously dissected donors. Other donations are reserved at WVU for specialized resident training in the fields of surgery, orthopedics, neurosurgery, pathology, and emergency medicine, as well as a one-month intensive training program for medics within the U.S. Army Special Forces Green Berets (Grabo et al., 2020; McClelland et al., 2021).

The other half of the donations to WVU have a regional impact on numerous institutions across the states of West Virginia, Tennessee, Pennsylvania, Virginia, and Ohio (Figure 1). Within the state, WVU supplies human donations to West Liberty University and previously to Alderson-Broadus University, which closed in 2023. Outside of West Virginia, the Lincoln Memorial University Debusk College of Osteopathic Medicine (LMU-DCOM) in Tennessee receives a significant number of donors to help supplement education of their medical students. Interestingly, shipments to LMU-DCOM nearly tripled during the COVID-19 pandemic, from only 34 donors/year to 102 donors/year, coinciding with the opening of a second campus in Knoxville, TN. Greater Pittsburgh area schools including Duquesne University, Seton Hill University, Chatham University, and Carlow University receive several dozen donors to help supplement their growing professional programs. Beyond this regional impact, WVU also maintains a long-standing collaboration with National University of Science and Technology in Sohar, Oman, in which several prosected donors are transported every few years to supplement medical education. In such cases, WVU HGR receives the remains of each donor upon completion of study, at which point the remains are cremated and returned to the donor’s respective family.

Geographic Impact of Human Gift Registry at Marshall University

Marshall has received roughly 13% of the human gift donations (approximately 60 donors per year) in the state of West Virginia over the past seven years (Figure 2). Of these donations, roughly 41% are maintained within the institution to supplement medical, physician assistant, and physical therapy programs. Another 11% are sent regionally, namely to two institutions in Georgia: Mercer University and Dalton State University. Similar to trends observed at WVU, Marshall University saw a marked increase in the shipment to these two institutions following the

onset of the COVID-19 pandemic to help supplement their anatomical education. Impressively, the remaining 48% of the Marshall University’s gifts over the past five years has been transported overseas, representing a strong global impact (Figure 3). Marshall’s HGR maintains a collaboration with the medical schools in the Caribbean, namely University of Medicine and Health Sciences at St. Kitts and St. George’s University on the island of Grenada, where these donors supplement anatomical education in locations where a local HGR would be difficult to manage due to population and facility limitations. Like WVU’s HGR, all donors are returned to Marshall University upon completion of study to be cremated so that each donor’s ashes can be returned to their respective family.

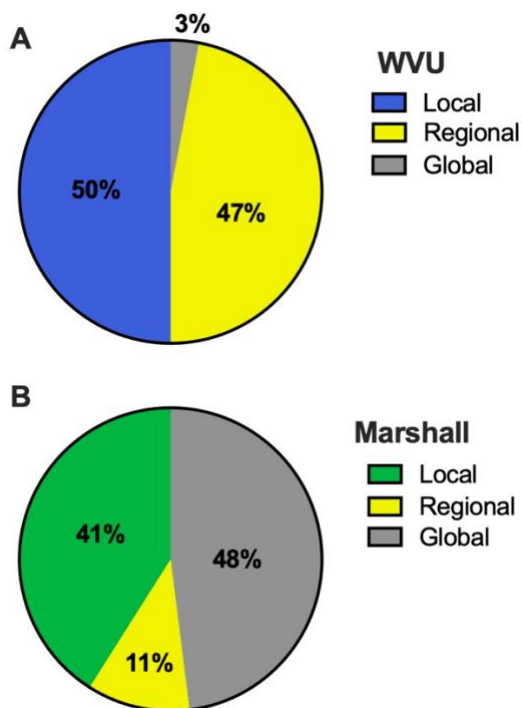


Figure 3. Geographical Distribution of Donors from West Virginia Human Gift Registries. Visual representation of how donors are used either locally (within institution), regionally (transported to nearby institutions within the U.S.), or globally (overseas) at WVU and Marshall HGRs. Data were averaged over a five-year period (2018-2022). A) The WVU HGR has a nearly 1:1 ratio in local vs. regional distribution. A small contingency of donations is transported internationally every few years in a long-standing collaboration with the National University of Science and Technology in Oman. B) Contrarily, the Marshall HGR has a nearly 1:1 ratio in local vs. international distribution, given significant contributions to Caribbean medical schools. A smaller contingency of bodies is transported to regional institutions. Note: All whole-body donations in Lewisburg are maintained internally at WVSOM, and thus, there are no collaborative programs currently established.

Geographic Impact of Human Gift Registry at West Virginia School of Osteopathic Medicine

WVSOM has received an average of 51 donations over the past seven years, representing 12% of all the human gift donations in the state of West Virginia. Unlike the other two HGRs previously described, WVSOM uses all their anatomical gifts within the institution to support medical education of their osteopathic medical school.

Impact of COVID-19

Figure 2A demonstrates the impact of the COVID-19 pandemic on WV HGRs from 2020-2021. During this time, classrooms across the globe were forced to move into virtual learning, which posed many challenges for the kinesthetic nature of human anatomy education (Singal et al., 2021). Many schools were required to close their doors temporarily to their anatomy labs, which had a profound impact on whole-body donation tendencies in WV. In 2019, WV HGRs had a record year, receiving 571 human donations. This number plummeted heavily to 463 donors in 2020, and continued to fall to 372 donors in 2021, demonstrating the lasting impact of the pandemic. This drop can be attributed to the COVID guidelines in place during the pandemic, which varied from state-to-state and by institution. COVID-related deaths were automatically barred from WV HGRs, and donors with any respiratory illness listed among their cause of death were not accepted. Some states imposed strict COVID-testing guidelines, even for the deceased, which increased overall resistance to the provision of whole-body donations (McCumber et al., 2021). WVU’s HGR experienced significant drops in overall shipments to the state of Virginia. Simultaneously, however, WVU and Marshall University saw significant increases in shipments to select schools. As mentioned, WVU shipments to LMU-DCOM nearly tripled from 2018-2022 to supplement their two campuses in Harrogate and Knoxville, TN, while Marshall University shipments to the two schools in Georgia increased from just one donor in 2019 to 17 donors in 2021-2022. Much like the rest of modern society, human anatomy education had to adapt to the circumstances of the global pandemic. Fortunately, numbers of donations rebounded in 2022, with 412 overall total donors in West Virginia HGRs (Figure 2), as in-person anatomy instruction has resumed in our institutions.

Discussion

Several groups may find this model of HGR management to be useful. Firstly, other State Anatomical Boards may be interested in the benefits of a centralized HGR model, particularly in rural areas of the country. HGRs are non-profit-organizations, which have intrinsic socioeconomic obstacles. Some challenges include, but are not limited to transportation of bodies, dedicated space and maintenance of the morgue and dissection labs, portable stainless steel dissection tables, specialized instrumentation, chemical reagents, and salaries of faculty and staff. Given these barriers, there is incentive for larger universities to serve as the sites of the HGRs and for smaller universities to request donors, such that the smaller institutions are not required to maintain their own HGR.

Secondly, those studying the impact of the COVID-19 pandemic on higher education may be interested in this information. These data demonstrate the impact of the pandemic on our HGR operation in WV and how the HGRs have begun to recover as in-person gross anatomy education has been re-established. Other institutions faced similar hardships in facilitation of dissection-based anatomy courses during this time. The temporary closure of the anatomy lab and shift to virtual education has led some to revisit a recurring debate among universities, administration, and anatomy departments regarding the long-term feasibility of HGRs and human anatomy. Over the past several decades, many universities have elected to move away from dissection-based anatomy courses, leveraging virtual anatomy or other modern technology as a replacement to skirt the economic costs of an HGR (Cope et al., 2021). However, there is no replacement for dissection-based anatomy (Zdilla, 2020). The pearls of dissection-based anatomy lie within the discovery between the fascial layers and the variation between every donor. No technology can replicate the experience of dissecting neurovasculature from a connective tissue sheath or appreciating the organization of deep fascia and its intermuscular septa invaginations. A student in an anatomy lab is quick to learn that no two bodies are the same, gaining an immediate, tangible appreciation of how their future patients will vary in structure. In addition to anatomical variation, students also uncover differences in medical history, ranging from cardiopulmonary disease, cancer and metastasis, joint replacements, missing organs

(hysterectomy, cholecystectomy, appendectomy, bowel resection), and countless other pathologies., all of which help to prepare our students for their respective careers. It is for these discoveries, coupled with the dignity, compassion, and respect gained through the experience, that dissection-based anatomy is irreplaceable. The resiliency of WV HGRs through the COVID-19 pandemic demonstrates West Virginia's commitment to human gross anatomy.

Most importantly, this information may provide West Virginians with a better sense of how their decision to donate their body can impact future health professionals in West Virginia and surrounding communities. Our donors have made the conscious decision to contribute to society for a second time. In the post-mortem life, a single anatomical gift may impact several hundred students over a 12-24-month period. The experience enables our students to confront the intricacies of human structure firsthand. As human structure serves as the basis for biology and disease, the decision to donate carves a path to help train more competent, knowledgeable, and compassionate health care professionals for future generations.

Acknowledgements

On behalf of all three HGRs in the state of West Virginia, we would like to extend a special thank you to the donors (past, present, and future) who make human gross anatomy possible. It will remain a priority of West Virginia HGRs and anatomy programs to treat our donors with the utmost respect in response to the compassionate, selfless act of their donation.

To learn more about the act of human body donation in the state of West Virginia, including updates on memorial services for donors, please visit one of our HGR websites.

WVU: <https://medicine.hsc.wvu.edu/anatomy/human-gift-registry/>
 Marshall: <https://jcesom.marshall.edu/departments-divisions/human-gift-registry/>
 WVSOM: <https://www.wvsom.edu/giving/human-gift>

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