Linking Local Waste Stream Reduction to Global Health: OSU Medical Center's Potential to Make a Difference

A Senior Honors Thesis

Presented in Partial Fulfillment of the Requirements for graduation *with research distinction* in the undergraduate colleges of The Ohio State University

By

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March 2009

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Introduction

The Ohio State University Medical Center (OSUMC) has gained considerable prestige from a variety of medically-related organizations and U.S. News & World Report magazine. "[OSUMC] was listed among the safest and most effective medical centers in the country by the Leapfrog Group, a consortium of Fortune 500 companies that pay for the health care needs of millions of Americans" (5).

Now imagine a place where the nearest medical facility is located in a neighboring community. Imagine recovering from a surgical procedure without adequate amounts of gauze or bandages. Imagine a healthcare system that is so under-funded by the government, that access to medical attention is suspended for months at a time. Compared to the healthcare system offered at OSUMC and other Columbus hospitals, these characteristics of medical practice seem a world away. And they are. In striking contrast to American medical care, such situations shockingly permeate many underdeveloped countries today.

So while in 2006, the Ohio EPA claimed that our nation produces approximately 7.6 billion tons of industrial solid waste and Ohio *alone* generates 33 million tons of solid waste each year, hospitals of the developing world are pressed to find latex examining gloves for their medical facilities (20). As a component to this gross volume of solid waste production, an early 1990's estimate projected that "medical waste is generated at a rate of 3.5 million tons per year. This statistic is amplified by the increasing prevalence of home health care, which [circa 1990's] generate[d] waste at about 50,000 tons per year (18)." *But is it really all waste?* With such a tremendous volume of medical refuse, there seems a high likelihood that reusable medical product comprises a significant annual percentage of this "waste" stream. And as pressure to be "green" in our society escalates, colleges across the country have been called to make significant

strides in promoting a more sustainable world. The question then is: Can OSUMC be part of a greener and fairer world by reorienting its "waste" towards needy countries? The purpose of this thesis is to address that question.

Chapter 1: A Background for Medical Waste Generation

"Greening" Universities and Medical Centers: National and Local Initiatives

"Health care costs are already a huge topic of interest in the daily press, and our health care executives are making attempts to reduce the waste within our systems (13)". In fact, institutions across the country have been actively addressing environmental issues related to water conservation, solid material recycling, and soil and landfill preservation. For example, the University of Minnesota has established the first ever wide-scale turbine for green energy sources, where "wind power [now] supplies up to 60 percent of UMM's electricity needs" (10). Additionally, Johns Hopkins University in Baltimore has implemented "green roofs" atop various building throughout their campus. "Green roofs are natural vegetative covers that help control storm water runoff and reduce energy use by insulating buildings from temperature extremes" (21). One hospital in Vermont operates a kitchen composting program for all food waste generated within a 400-500 bed hospital. With an average production of 4,000 meals daily, approximately 900-1,200 pounds of food prep waste are generated *every day*. Coffee grounds, alone, contribute to a significant portion of this waste, especially if one considers that fifty percent of a 6,000 employee hospital drinks just one cup of coffee every day; it is a quick way that this hospital can accumulate an excess of coffee grounds from the production of just 3,000 cups of coffee per day. The State University of New York at Buffalo has been promoting eco-friendly policies and classroom education for nearly a *decade* now, with its 2001 publication of "Environmental Stewardship and the Green Campus" booklet (17). But it is not just hospitals scattered around the country that are jumping onto the green medicine 'bandwagon'; more environmentally conscious efforts are occurring right now in our own backyard.

Through my investigatory process of determining what kinds of waste streams are generated throughout OSUMC, I became aware of other Columbus area hospitals and their efforts to collect and recycle. For example, an employee and registered nurse at Nationwide Children's Hospital is conducting her own diversion stream for medical surplus, spending up to ten hours a week collecting durable medical product from different departments in her hospital, organizing her collected goods in a storage house, and redistributing these supplies on an individual request basis for physicians taking their practice overseas. Better yet, Licking Memorial Hospital, a small community hospital in Newark, Ohio is managing several initiatives to reduce its ecological footprint, including an in-house laundry effort and two major endeavors within their operating department. At this hospital, two 400 pound washing machines and mechanical irons can press and fold 800 sheets every thirty minutes, supplying the entire hospital with all its necessary sheets, towels and blankets needed seven days a week. In this way, Licking Memorial creates a much smaller ecological footprint by preventing up to a pound of air pollution that would be produced for each mile driven by a motor vehicle to outsource this service through a laundromat contract. In-house laundry also serves a potential recovery center for artificial dentures, which are the leading displaced items in a hospital, often winding up in the laundry stream. By keeping laundry in-house, a hospital creates a better opportunity to prevent spending on the replacement of these lost items. OSUMC, for example, "spends up to $17,000 annually on the replacement of lost dentures for patients frequenting the hospital" (17).

While "it has been shown that disposable, single-use linens and paper account for 69% of the waste volume in the OR, Licking Memorial Hospital takes its green medicine even further in their operating rooms (16). OR surgeons currently manage a towel collection program, wherein the unused surgical towels from an opened pack of six are redirected from regular solid waste on

a daily basis (See Box 1). Between their ten operating rooms and four procedure rooms, an estimated *6 tons* of towels are spared each year from an average opening of fifteen towel packs per operating room every day. Assuming each pack of six towels weighs one pound, an estimated 54,750 pounds are opened each year, but preventing 12,000 of these towel pounds equates to a savings of one towel out of every six, on average, each time that a pack is opened. This is an 18% savings of regular annual landfill poundage expense for the hospital, not to mention that this recycling program actually generates money for Licking Memorial as outside organizations purchase their unused towels for a fixed rate. But the operating rooms at Licking Memorial are even greener. In place of a typical quad of plastic suction containers used for the collection of biohazardous fluids from surgical procedures is a self-cleaning and reusable Neptune System. This efficient and easily maneuvered system is comprised of two large collection canisters which effectively replace the amount of bulky and often partially-used plastic waste containers destined for the landfills with every operating procedure. In a working capacity of 6,600 operations annually, Licking Memorial is saving a minimum of 26,400 suction canisters from the solid waste stream each year.

Box 1: Surplus in ORs

Licking Memorial Hospital in Newark, Ohio, performs an annual average of 6,600 operations within a 200-bed patient capacity.

Assuming that OSUMC has about 500 beds, its proportional annual operations respectively reach around 16,500.
That means there are 16,500 opportunities for surgeons to dispose of reusable medical product per year.

If, on average, 2-3 items could be diverted from the waste stream during each operation, OSUMC could potentially retain 33,000-49,500 items annually from operating procedures alone.

These observations from other Columbus area hospitals lead me to conclude that OSUMC, too, has an obligation and a tremendous opportunity to link the green movement with

the diversion of its medical surplus materials in central Ohio. More pivotal still, the annual collection of OSUMC's massive production in solid wastes could save lives on an international level.

Life-Saving Surplus: Medical "Waste" Overseas

Intimately entrenched in the push for a more efficient and sustainable world is the pressure to raise global healthcare standards through humanitarian aid. British researchers note, for example, that "It is being increasingly recognized that only a fraction of healthcare waste requires special attention and that the development of recycling programs for healthcare waste can serve as a means of reducing rising quantities and treatment costs" (21). Costs, in this way, are both a financial and humanitarian loss, **because much of a hospital's waste stream is reusable medical supplies.**

In fact, it is well known that global health initiatives are often strapped for adequate medical supplies, even when personnel are available. For example, 6,500 people die daily from HIV/AIDS in sub-Saharan Africa; a lack of resources poses a "significant challenge" in providing comfort for these victims (11). "By ensuring that basic medical supplies are available on an ongoing basis, hospices can utilize resources more efficiently and increase the number of patients they are able to serve" (11). Despite the establishment and continued financial and medical support, worldwide humanitarian aid largely falls short of adequate supplies. And yet, first-world hospitals routinely throw away perfectly good materials daily: "A large contributing factor to the increase in healthcare waste has been linked to the increased use of disposables in healthcare" (21). In American hospitals, this means that a significant portion of their waste stream includes supplies such as gauze, surgical sutures, latex gloves, and sanitary collection

containers that go unclaimed within a world of need. Why do hospitals throw these valuable supplies away? For one, the FDA has established strict expiration and sanitation regulations for solid medical supplies, which spur hospitals nationwide to generate a bulk of surplus medical supplies from the termination of these time standards (16). FDA limitations render components within opened surgical packs as unusable, even if the integrity of their sanitation is maintained. More importantly, however, hospitals may be unaware of the value of rerouting these supplies for developing countries worldwide before the surplus reaches our local landfills. Thus, abhorrently under-recognized within the healthcare community lays a nearly unbeknown niche for environmental and humanitarian improvement. Thus emerges the impetus for this research project.

Literature Review

The truth about medical surplus collection is that awareness for this issue is on the rise, and an increasing number of academic discussions are being published as this humanitarian issue continues to draw the attention of hospital administrators, environmentalists, and international health organizations. "Nothing in health care remains the same for long […] In the next 10 years, "going green" will no longer be a fad but a part of our daily lives (13)." A "Regulatory Update" published in a 2003 issue of *Health Facilities Management* cited the American Hospital Association's announcement to begin encouraging its member hospitals to support medical facilities in Afghanistan with US-donated medical equipment and surplus supplies. "Many hospitals in Afghanistan operate with partial electricity, no laboratory equipment, worn out beds, and little or no medical or surgical equipment (17)." The pilot program will be accepting supplies donations from East Coast Hospitals in coordination with a nonprofit organization

called Global Watch Group (17). In 2005, the same magazine featured Lemeul Shattuck, a 278-bed hospital in Jamaica Plain, Massachusetts, for its hospital-wide recycling programs for woods, metal, cardboard, paper, batteries, medical waste and regular waste. In the first year of its environmentally-geared infancy, the hospital "generated 11 percent less trash, saved roughly $11,000 in avoided disposal costs, and more than quadrupled its recycling— from 14 tons to 58 tons" (4). More recent still, a 2007 case study analysis of one repurposing partnership between the University of Texas Health Sciences Center and Hospital de San Jose in Columbia, Latin America has been discussed in a November edition of *AORN Journal* (16). "In countries like Colombia where health care is not available to everyone, donated medical devices and equipment play an important role in making services available to many who cannot afford them (16)." The following abstract for this article introduces the evidence that a medical surplus recycling program is both a beneficial and feasible option for American hospitals, already operating in one Texan medical facility today.

> *Refuse and recycling of donated and purchased items can allow health care facilities in developing countries to remain financially viable and provide services to those who could not otherwise afford them. In one Bogota, Columbia, hospital, surgical instrumentation professionals and other clinicians developed reuse and recycling protocols for the OR. Although not all of the practices described would be acceptable in the United States, these practices are a direct consequence of the impact of poverty on health care systems in a developing country. AORN } 86 (November 2007) 791-797. © AORN, Inc, 2007 (16).*

Thesis Objectives

The goal of this research project is to investigate the potential for future diversion of the solid waste streamline at OSUMC, and how this diversion could contribute to a greener environment and enhance a humanitarian cause. The following objectives guide this project:

1. To quantify the amount of annual solid waste produced at OSUMC

a. *Where does the waste go?*

b. *What percentage of the solid waste produced is usable medical surplus?*

c. *How much annual expense is lost in the surplus supplies generated by the hospital?*

2. To initiate a debate within the OSUMC community about the diversion of the solid waste stream, and its potential to contribute to real humanitarian aid a world away

   a. Who is responsible for tracking and managing the solid waste generation at OSUMC?

   b. What are administrators' perceptions of possible alternatives to disposal of re-useable, but expired, supplies? Is there administrative support for the collection and diversion of re-usable wastes for international use?

   c. What difference can 'leftover' supplies from the U.S. make to the provision of health care in an under-funded country such as Uganda?

3. What other hospitals in Ohio have had success in reducing their environmental footprint by re-routing their re-usable waste to developing countries?

Organization of the Thesis

Divided into a total of nine chapters, this thesis presents the issue of medical surplus generation, including how surplus is created in a hospital and reasons why a hospital should collect these reusable supplies. A mini case study then follows, which tracks one person's individual quest to recycle reusable medical supplies at Nationwide Children's Hospital in Columbus, Ohio as evidence for the existence of this waste stream in hospitals. Next, this thesis takes an in-depth look at the healthcare standards which exist in the developing world, in order to

show the immense opportunity for durable medical product to impact these impoverished nations. Finally, a rerouting scheme is presented, which outlines how OSUMC and other Columbus hospitals could begin to mobilize their reusable medical surplus. As a component to this analysis, the thesis highlights a few repurposing organizations already operating in the United States, and discusses the ethical issues associated with internationally donating surplus medical supplies.

Chapter 2: Research Methods

To answer my research objectives, I relied heavily on my interpersonal skills and my ability to initiate conversations and probe for topical details while engaging with an individual for the first time. Thus, the bulk of the new information I present here was gathered from one-on-one intensive interviews, often occurring in the daily environments and routines of the individuals interviewed. Because recycling programs related to medical surplus are rare in central Ohio, I was constantly transcribing my notes from interviews in one hospital, and networking with similar departments in other Columbus hospitals for complimentary information and cross-referencing checks to ensure accuracy in the information I had obtained. The data analysis section of this research also relied heavily on collecting statistical values from one source, and interpreting them with another source. While my original intent was to assess OSUMC's waste streamline for reusable medical supplies, the reality was that the volumes and cost values for these medical surplus items were not tracked at OSUMC. Thus, I took advantage of information provided by other hospitals to supplement OSUMC's missing data in an effort to propose a model picture of how an average medical waste streamline may exist in a Columbus hospital.

Research Funding

Before submitting my research grant proposal for this project, which was later awarded $8,000 from OSU's Honors College of Arts and Sciences, I did some preliminary research in our local Columbus community for guidance on where and how to begin investigating the waste streamline at OSU Medical Center. I came into contact with Susan Kroll, the Associate Vice President for Health Sciences and Director of Prior Health Sciences Library at a global health

lecture on campus. She, in turn, referred me to Dr. Andy Thomas, Associate Medical Director of University Hospitals, and Dr. Dan Sedmak, Executive Director, Center for Global Health. Through two separate one-on-one interviews, I presented my research objectives to be incorporated in my grant proposal, and asked for additional contacts and departments within University Hospital who could provide me with the knowledge and numerical data I would need for my assessments.

Preliminary Data Gathering on the Logistics of a Medical Surplus Diversion

The idea and interest for this research project was sparked by a previous class assignment for Geography 605 during winter quarter, 2008 (see Timeline, Box 2). I initiated research for this class assignment through a phone-conducted interview with Tish Dahlby, the Executive Director of MedWish International, a nonprofit organization based in Cleveland that collects medical surplus from Cleveland clinics and other hospitals dispersed within the state of Ohio. MedWish International then sorts and redistributes medical surplus to hospitals and medical clinics among developing countries worldwide. In speaking with Tish Dahlby, I was invited to later visit MedWish for a day in July 2008 to shadow and observe her normal routine in managing this enterprise. Consequently, I toured the sorting and packing areas within the building, audited a meeting with an additional nonprofit repurposing organization, and obtained MedWish International's 2008 annual report and further readings for data collection.

Medical Surplus in Use: Learning in Iganga, Uganda

Thus, I had begun to pursue some of the contacts and resources I had found in my groundwork research for this project. But talking about medical collection and its potential

impact in the communities of impoverished nations was hard grasp in Columbus. So I decided to go to one of those "third world" nations, and see the need for myself. I organized a medical internship through an international placement agency called Experiential Learning International, or ELI. The scholarship received from the Honor's College of Arts and Sciences for this project helped fund the bulk of my travel, lodging, and food expenses to a district hospital in Iganga, Uganda. As it turned out, a mere twenty-one hours in an airplane brought me to Entebbe International Airport in Uganda, where I met the wife and daughters of a Ugandan ELI representative, Michael Kaidhiwa, who took me to the house of Sister Baruka Rose, a nurse at the hospital with whom I stayed for approximately thirty days. Much of my researching and exposure among the hospital wards was conducted by joining physicians, including Dr. George, Dr. Jude and Dr. Dennis, in their daily patient rounds within the female, pediatric, and maternity wards. However, I was not limited to accompanying a medical professional, but in fact was able to create my own daily schedule additionally among the hospital nutritionist, Ahmed, several midwives, including Sister Joy (in their delivery room), laboratory technicians including Julius, some operating theater staff, Simon and Tom, and professionals at a medical clinic, Sister Justine and lab supervisor, John ("like John the Baptist"). In addition to these Ugandan hospital workers, I met several *muzungu*s (Lugandan word meaning "white-skinned") volunteers, including a former Australian nurse, Janice, and her EMT friend, Vanessa Burgess, a midwife from the UK, Anne Duchene, and some

Figure 1: Ugandan Orphan. 8.15.08. Photo by L. Thornhill

American students working in an orphanage (see Figure 1): Emily, Hillary and Andrea. I also had some fantastic and friendly neighbors next to my host house, including teenagers Sarah Adeke and Faith Nyemera, Stephen, and David. In sum, I cannot list the countless numbers of Ugandans who helped me find various locations en route around the country, the additional numbers of nurses and midwives in the hospital, and the expansive masses of taxi drivers, grocers, mercantiles, and servers who contributed to this unequivocal cultural and learning experience.

Intensive Data Collection in Columbus, Ohio

Through various visits to the ground floor of OSUMC, I came to understand the organization and management of the waste stream through two major departments: Distribution Services and Environmental. My first significant meeting with OSU medical representatives was conducted with Carl Story, the Director of Distribution Services, Materials Handling, and Distribution. Also in attendance was Bruce McPherson, a manager for Material Systems, and Brent Jones, a supply coordinator for Material Systems, Handling, and Distribution.

In discussing my research goals and interests in initiating a recycling program at OSU Medical Center, I learned that Distribution Services manages the purchasing orders and influx of most, if not all, medical products from the manufacturers. In addition, the Distribution Services department is involved in redistributing bulk orders to various areas within the hospital when misplaced orders occur, or when large quantities of packaged medical supply are cleared from floor stock rooms for a change in brand name, and/or model. OSU's Automated Transport System, a preprogrammed robotic waste collection system, is overseen by this same department. My meeting with these representatives concluded with a guided tour of the ground floor, and

further contact information for various departments of the hospital via email recommendation and introduction by Carl Story. My follow-up research with these individuals relied on telephone conversations. Thus, Carl Story and his team within Distribution Services partner closely with the Environmental Department, which manages materials exiting OSU Medical Center.

I visited the Environmental Department at OSUMC, which resides adjacent to Distribution Services on the ground level of this hospital. My interest in investigating this end of the waste streamline was assisted by recommendation per Carl Story to meet with Jerry Hamilton, Director of Environmental Services. During my visit to this area, I obtained a better understanding of where and how mainstream waste is compacted and stacked for landfill pickup, how biohazardous waste is handled, and how OSU Medical Center conducts recycling programs for paper, cardboard, glass, plastics, and other reusable products. It was also in this visit with Jerry Hamilton that I obtained computer records of waste management data of the entire University Hospital from 2006-2009 fiscal years.

My investigation of medical surplus has not been limited to OSU Medical Center alone, and in fact continues to expand with additional contacts in other Columbus hospitals including Dai Wei Lo and Steve Swift from Nationwide Children's Hospital, Susan Zabo from Ohio Health Association, and private volunteers such as Mrs. Fabiola Heintz-Blanco. Accompanied by Dai Wei Lo, I toured Nationwide Children's Hospital (NCH) and its privately-owned house which is used for sorting and storage of the medical surplus she personally collects from bins she has introduced to various departments in this hospital. Dai Wei Lo additionally gave me a copy of her collection records since she began her routine pickup of reclaimed medical supplies from these collection bins in June 2007. Dai Wei Lo and Fabiola Heintz-Blanco also work with Tish

Dahlby at MedWish International, and have donated and transported medical surplus collected within the Columbus area on an individual basis. In joining Fabiola Heintz-Blanco to a meeting at MedWish International, I was provided a copy of her logbook in which she has recorded her mileage and volumes of donations taken to MedWish International in Cleveland, Ohio since March 2008.

By invitation of Susan Zabo, I also attended a Pollution Prevention (P2) waste assessment conference hosted by Licking Memorial Hospital in Newark, Ohio. During the two-day program, representatives from different hospitals in Ohio toured each department of Licking Memorial Hospital, learned about the various waste streamlines generated by department, and discussed several opportunities for each department to operate in more environmentally efficient manners. I also obtained some numerical data for recycling programs at Licking Memorial Hospital, as examples of alternative ways in which central Ohio hospitals are practicing greener medicine.

A final component to my data collection and interpretation consisted of a file of medical surplus cost values from the database of MedWish International, thanks to Tish Dahlby. The inventory records provided by Dai Wei Lo from Nationwide Children's Hospital were then indexed in this cost value database to extrapolate a total value sum of items collected from NCH by Dai Wei Lo's individual efforts since June 2007.

I continue to work in coordination with the expanding network of professionals in their respective fields to further raise awareness about the need for medical surplus repurposing. Tish Dahlby remains a helpful partner and potential key component in getting this medical surplus diversion started in Central Ohio. In addition, I remain in contact with Susan Zabo from Ohio Health Association, Carl Story in OSUMC's Distribution Services, Fabiola Heintz-Blanco and

Dai Wei from Nationwide Children's Hospital, and will be re-contacting OSUMC administrators upon completion of this thesis. With this continued communication, it is increasingly more likely that such an enterprise will eventually be enacted among Central Ohio hospitals. The cooperation and eagerness of such professionals to volunteer their time, information, and fellow peers has propelled this project to be more objective in its economic assessment and clearer in its logistical analysis for recovery of the medical surplus streamline.

Box 2: Research Methods Timeline

<u>2008</u>	
March:	*Mini-research class project completed for Geography 605*
April:	*Interview conducted with Dr. Dan Sedmak, Dr. Andy Thomas, and Susan Kroll*
May:	*Research grant proposal submitted to Honors and Scholars Department*
June :	*$8,000 awarded for research project funding*
July:	*Visited Tish Dahlby and MedWish International in Cleveland, OH, audited meeting with CAMO at MedWish*
August:	*Medical internship in Iganga District Hospital, Uganda*
October:	*Meeting with representatives of Distribution Services at OSUMC, including Carl Story, Bill McPherson, and Brent Jones*
November:	*Obtained waste management records from OSUMC Environmental Director, Jerry Hamilton; meeting with Dai Wei Lo, Fabiola Heintz-Blanco, and Tish Dahlby at MedWish International; research relevant scholarly journal literature*
December:	*Obtained tracking records for medical surplus collected by Dai Wei Lo at Nationwide Children's Hospital*
<u>2009</u>	
January:	*Began thesis writing*
February:	*Obtained cost values from Tish Dahlby and MedWish International for Dai Wei Lo's medical surplus inventory; attended P2U conference at Licking Memorial Hospital*
March:	*Gave oral defense for research distinction committee and submitted final thesis*

Chapter 3: How Surplus Is Generated in Hospitals

On the headlines of any annual waste management hospital report, a title suggesting "we are throwing X percentage of medical surplus into our landfills" will simply not appear. Nor will any numbers in tonnage or dollar amounts be included in annual waste reports that reflect the volume and financial cost contained in such medical resources which are discarded into the waste streamline by Columbus hospitals. From closer investigation of OSU Medical Center, these statistics are slipping through the cracks. In fact, none of these quantities are reported because their records are not tracked. In terms of OSUMC, waste generated at the hospital is managed under two major departments: Distribution Services and Environmental. Where Distribution Services is mainly responsible for the influx of bulk ordering of medical supplies, Environmental handles the outgoing landfill waste, biohazardous waste, and recyclable products such as plastics and cardboard. It seems that the disconnect in tracking such medical surplus is a lack of medical surplus receptacles among the floors of OSUMC to "skim" these items from the regular biohazardous bins and general trashcans. The bottom line is that despite a lack of record-keeping of such re-usable items within OSUMC, medical surplus is most assuredly being generated and discarded daily. The evidence for such existence of medical surplus can be understood by identifying the many sources for its generation. A closer look at the following reasons why medical surplus is generated on a daily basis in a typical Columbus hospital will speak boldly to the inexplicability of why it is not being already being tracked and managed.

Hospital Purchasing Departments

The first area for medical surplus to accumulate in a hospital coincides with purchasing orders from medical suppliers for a particular department in the hospital. Instances such as a

mis-order, whether related to the wrong product brand name or item model, create a bulk volume within the Distribution Services department, located on the ground floor at OSUMC. Distribution Services has the responsibility to either try to return the product order back to the supplier, or to find another department within the hospital that could use the mis-ordered items and give an internal credit to the original department that ordered the medical supplies. In many cases, the supplier is willing to refund a mis-ordered purchase, allowing the hospital to return the product for a full refund value. However, depending on the restrictions of the manufacturer, items purchased in bulk may not always be allowed to be returned, particularly if any tampering whatsoever to the original packaging has occurred. Moreover, redistribution of a mis-order within the hospital can be a significant challenge for Distribution Services when the ordered items are specifically tailored to the needs of a particular department. For instance, the neo-natal unit ordering respiratory bags for newborn infants are so characteristically designed for their department that these items would never be able to be used in cardiology or radiology units. While mis-orders may be "rare" within a hospital, certainly these events do occur, and it is one of the initial ways in which a hospital can generate perfectly reusable medical equipment, and yet at times be forced to absorb its cost and add it to mainstream waste.

Patient Recovery Rooms

The next source for the generation of medical surplus in a hospital occurs in patient recovery rooms, in which certain items indentified by law are required to be present. These items are already included in the expenses of admitted patients. Such items as masks and ambulatory bags (needed for unexpected times of patient resuscitation) are individualized, opened medical equipment which is discarded if not used upon the discharge of the patient from

the room. Patients being admitted and discharged on a daily basis within a hospital only means that a steady inflow and outflow of medical supplies exists. Such mandatory patient room items are required to be discarded into mainstream waste by federal law due to sterility and expiration issues. However, such medical supplies, which are intact and unused, would be readily used in under-supplied hospitals of developing countries. Without rerouting these items from the waste streamline, we as Columbus citizens only contribute to an increasingly wealthier "pit of soil" when items which are purchased and unused are filling our landfills.

Change in Product Brand Name

Medical equipment and technology is continuously evolving within the healthcare field. In response to this, hospitals can easily generate large bulks of medical surplus from a change in brand name of a particular product, whereby leftover product of the original brand are displaced from hospital storage closets. Such a change in brand name can either be the result of the item being discontinued by the original manufacturer, the remnant of a newly updated product, or remaining items specially ordered by a physician in a trial period. In the latter case, the medical surplus is the result of a manufacturer representative who often donates a bulk quantity of a particular product to a hospital specialist as a promotion and marking implement deemed "a trial period." In the cases in which the specialist does not like the new brand or model, the packed and unused item meets its landfill fate. Think about normal hospital operations. Pharmaceutical and manufacturing representatives are constantly visiting hospitals and offering their products on a *daily* basis. So the irony of this marketing game is that our Columbus hospitals can rapidly discard medical product in search for the newest technology, while hospitals in, say, Guatemala, struggle to maintain their bare minimum of essential gauze and glove supplies.

Expiration of Sterile Product

Expiration dates and sterility issues contribute to the largest medical surplus generation within a hospital. Medical surplus produced in these ways is due to strict FDA regulation, by which all hospitals and medical professionals must abide. Expiration dates are mandated on nearly every medical and nonmedical item within a hospital setting, and the time constraints vary greatly among pre-packaged supplies, such as a surgical catheter kit, to individual medical products, such as plastic specimen collection tubes. In the case of various surgical packs in which items such as gauze, gloves, tubing, and iodine containers are all incorporated into a sealed tray, expiration of the entire package is logically associated with the most recent item expiration date included; for instance, an expiration date on a catheter kit may reflect the bottle of sterilizing iodine included, yet the tubing and needles also packaged may remain completely usable for much longer. The result is that hospital staff are required by law to discard the entire kit into the waste streamline, while components of those packs could still be used in other hospitals around the world. This example presents even a more profoundly ethical element: the expired product reaches the trash even when its sterility remains *intact*.

A normal, mainstream waste route diagram for one example of a reusable medical item is shown in Figure 1. This particular example follows items being deposited into the biohazardous waste streamline, but the reality is that medical surplus products could be found in the solid waste streamline as well. While excess medical items are generated in a variety of ways within a hospital, the intent of Figure 2 is to demonstrate that supplies exiting these waste streams ultimately end up in available landfill space.

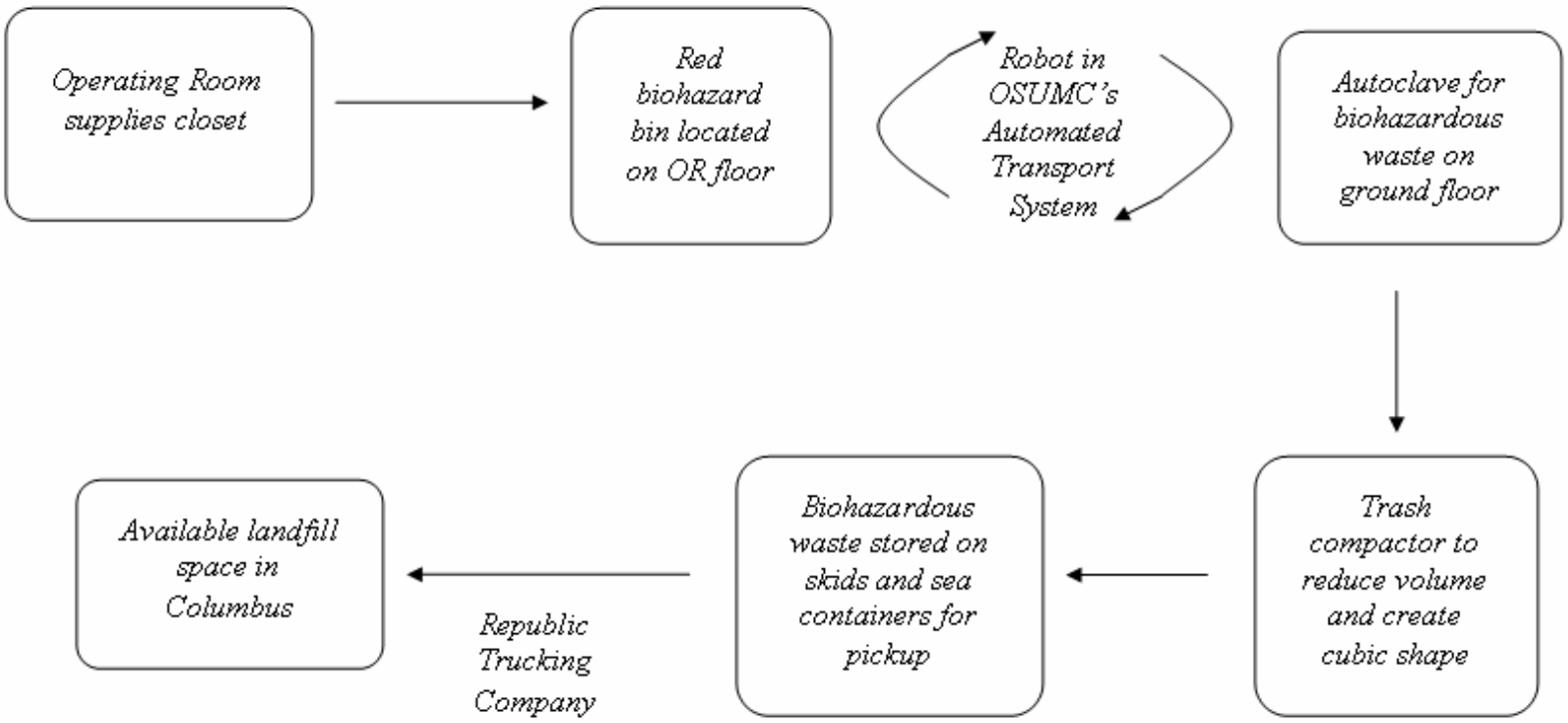


Figure 2:

The Life of a Catheter Kit with Sterility Intact but Past Expiration Date

Expiration of Opened Product

In other situations, the breach of sterility, in fact, becomes the issue. Take a classic scenario, for example, in which a bulk bag of plastic blood collection tubes is opened. When the expiration date for the unsealed package of tubes passes, any remaining blood vials, each individually sterilized, can no longer be used and are automatically discarded. Because medical supplies are purchased in bulk quantities within a hospital, this example is not at all an unlikely situation. Moreover, surgeries that get cancelled are prime sources for medical surplus generated from a breach in its sterility. Some simple example items of this include surgery pads and paper spill covers and curtains. In essence, when these bagged items are opened prematurely for an operation that becomes cancelled, the supplies must be discarded into mainstream waste despite being purchased and unused.

A Culture of Waste

There remains a final source for medical surplus generation in a Columbus hospital: general staff negligence. Perhaps a medical item, such as a pair of latex gloves, has passed all of the scenarios discussed previously. There still remains quite possibly the simplest way for these pair of gloves to disappear into the waste stream, unnoticed. Consider, for example, a typical nurse working at her maximum capacity with patients among a nursing unit. She makes a trip to her floor supply room and grabs a large handful of latex gloves which she shoves into the pocket of her scrubs uniform. Upon examination of each of her patients, she realizes she has grabbed an extra set of gloves, or even an odd number of them, to which she does not think twice about throwing the remaining one into the red biohazard waste bin which is conveniently located on

the entrance to her nursing lounge where she sits down and takes a break. In the general sense, this is an example of "clinical convenience". Instead of walking the extra pair of gloves back to the supply closet, dumping them into the waste stream is a more efficient use of her time. This example is not to condemn nursing units for the vast amounts of medical surplus generated by a hospital, but merely to demonstrate that the possibility for general disregard of the potential recyclability for medical products exists. And large, red biohazard bins are only calling out to be filled with a multitude of medical supplies that may or may not belong in that particular waste output of a hospital.

A Mini Economic Assessment Case Study: The Wrap on the Red Bag

Red bag biohazardous waste is designated for the collection of excretions, exudates, secretions, suctionings and other body fluids which contain infectious agents that cannot be directly discarded into the municipal sewer system. Grossly infected bloody medical materials are also designated contents for red biohazardous waste, although articles contaminated with fully absorbed or dried blood can be excluded from biohazardous waste and be deposited in regular solid waste. Sharp materials such as needles are destined for specifically labeled biohazardous sharps containers, as enforced by federal EPA regulations. According to Ohio EPA regulations, red biohazardous waste can be autoclaved as appropriate treatment so that this waste stream can be later combined with the regular solid waste in landfills.

In considering the potential for a hospital to retain its medical surplus generated, it is essential to target this particular waste streamline because red biohazardous waste represents a significant area for the likely accumulation of reusable medical product exiting the hospital under current operations. This phenomenon is due to three main contributing factors: the red

biohazardous receptacles are large, easily accessible containers which naturally attract waste, they are abundantly placed among a hospital and often in areas where they are not mandatory, and finally, they are not frequently distinctly labeled as to which items are exclusively meant to be disposed in them. For example, "Beth Israel Medical Center (New York, NY) has a program to rigorously reduce the amount of solid waste going into the designated "red bags" for biohazardous waste. This effort saves the hospital $900,000/year in disposal costs by reducing the amount of waste that must be treated (18)." If one considers a hypothetical estimate that durable medical product constitutes ten percent of the total red biohazardous weight annually exiting OSUMC, a simple cost analysis tracking red biohazardous spending can assess the impact of deflecting this reusable medical surplus weight from red biohazardous bags (see Box 3).

According to OSUMC red biohazardous waste records from the fiscal year of July 2006 to June 2007, 27,950 red biohazard bags were purchased at $0.96/bag. Because the total annual weight of red biohazardous waste[1] was 96,380 pounds, the average biohazardous red bag weighed 3.448 pounds that year. Considering a hypothetical situation, if 10% of the overall red bag weight were salvageable medical product, then reducing this volume in the biohazardous waste stream would save 10% less tonnage paid for pickup by OSUMC. Saving 10% of this total poundage would save OSUMC $2,258 per year. In addition to this poundage saved, expenses would also drop in purchasing red bag liners; reducing red bag liners by 10% would save OSUMC $2,683 per year. In sum, reducing red biohazardous waste by 10% annually would save OSUMC a minimum total of $4,941 annually.

[1] It is not known whether or not the "weight" of red biohazardous waste includes the weight of the corrugated cardboard box which is required to contain red biohazardous waste bags. If included, the average weight of actual medical waste per red bag is reduced even further.

Box 3: Red biohazardous Waste Facts for OSUMC

Hospital expenses to consider in calculating cost of red biohazardous waste disposal:
Cost of red bag liners
Cost of corrugated cardboard boxes which contain the bag liners
Poundage of biohazardous waste in red bags
Poundage of cardboard boxes
Fuel Charges per pick up
Charges for poundage of biohazardous waste vs. charge per box pickup

A typical cardboard biohazardous waste box weighs 2.2 lbs, and can often represent 12-15% of the total weight of each filled biohazard box alone. *If annual "weight" of red biohazardous material includes this weight of cardboard box containers, 12-15% of the July06-June07 annual tonnage equates to 11,570-14,460 pounds in cardboard box weight alone; boxes which are represent initial product purchase and then weight expense during pickup. Because the total expense per pound during this fiscal year was $0.23/lb,* **OSUMC spent $2,700-$3,380 paying for the weight of its biohazardous cardboard boxes**.

If the average cost of red biohazardous waste liners were reduced from $0.96/bag to $0.50/bag, *OSUMC would have spent $13,975 on red bags during July 06-June07 fiscal year, resulting in a* **48% savings** *from its actual expenditure of $26,800 on red bag liners.*

During the July06-June07 fiscal year, an average of **76.57 red biohazard bags were used per day***; from July07-February08, OSUMC was on track to use 77.069 red bags per day, which is a 1.006% increase.*

It is not known whether or not OSUMC is charged by total poundage for biohazardous waste, or by the cardboard box. However, during the July06-June07 fiscal year, the fuel charge/box was not constant, suggesting OSUMC is being charged by the box of biohazardous waste. In this case, OSUMC is operating grossly inefficiently if their average filled boxes weighed 3.448 pounds, when **red biohazardous bags can hold up to 50 pounds of waste per box**.

An additional area for hospital savings related to the red biohazardous waste streamline involves the replacement of the disposable cardboard box containers[2] with reusable plastic totes, which could be collected by OSUMC's Automated Transport System (see Chapter 8). Following a one-time, upfront investment in red plastic biohazardous collection bins, a hospital could dramatically reduce its annual spending related to the high volume of this corrugated cardboard

[2] The cost of corrugated cardboard boxes is unknown and presumably unaccounted for in biohazardous waste records at OSUMC, assuming it is not included in "price of liners" category of waste management records

in two ways: in saving money from purchasing the cardboard boxes themselves and in saving money in expenses associated with intrinsic cardboard box poundage. While the cost of one cardboard box is unknown, the annual total expense associated with the weight of 27,950 biohazardous cardboard boxes ranges from *$2,706* to *$3,383* alone[3]. Thus, total costs associated with purchasing 27,950 biohazardous cardboard boxes per year are elevated even more than *$2,706* to *$3,383* annual cardboard box expenses for OSUMC.

In addition to corrugated cardboard solid waste volumes, a general solid waste analysis is outlined in Box 4 below.

Box 4: Solid Waste Facts for OSUMC

The solid waste streamline infiltrates every department at Ohio State's University Hospital and thus represents a reasonable target in attracting medical supplies which could be repurposed from this waste streamline.

During the July06-June07 fiscal year, **OSUMC generated 3,594.18 tons** *through its solid waste streamline.*

During the July07-June08 fiscal year, total cost for disposing 3,564 tons of solid waste generated at OSUMC was nearly **$256,500**, *resulting in an* **average total cost of about $72 per ton of solid waste produced.**

In a hypothetical situation, assume that just 5% of this solid waste streamline could be attributed to reusable medical supplies. Then:
0.05 (3,594.2 tons) = 179.7 tons diverted from the solid waste streamline during 06-07 fiscal year
0.05 (3,564.4 tons) = 178.2 tons diverted from the solid waste streamline during 07-08 fiscal year
At a hospital expense rate of $71.95/ton, OSUMC could have saved about $12,930 during July06-June07 and $12,820 during July07-June08 fiscal years by preventing 5% of its total annual solid waste from entering this streamline.

Over this two-year coarse period, **OSUMC could have saved a net total of $25,750 by retaining 5% as durable medical product from its solid waste streamline alone**.

[3] This is based on estimates that corrugated cardboard boxes can comprise 12-15% of the total biohazardous waste poundage, which for OSUMC's July2006-June 2007 fiscal year equates to about 11,580-14,460 pounds in cardboard weight alone, assuming the total "weight" category in waste management records includes cardboard box weight.

Chapter 4: Why a Hospital Should Collect Medical Surplus

Six Reasons for Rerouting Medical Surplus

For a typical hospital employee or even an average citizen detached from the healthcare field, a proposal for the large-scale collection of medical surplus within a hospital probably seems both a daunting and insignificant task. Perhaps the very baseline reason that an individual would support such a grandiose effort is simply because 'it's the right thing to do.' But through my research findings, it has been made undoubtedly clear that there is significantly more rationale for a hospital to collect medical surplus. By researching and understanding medical surplus generation and its role in the waste mainstream, considerable effects of medical surplus diversion would be seen at both a local level *and* in larger, international communities of the world. In lieu of a more organized scheme, the following justifications for why a hospital should be motivated to collect its medical surplus are given in terms of the rewarding aspects to the hospital itself, beginning with the most significant.

Reason One: Cost Effectiveness

The first and leading reason why a hospital should collect its medical surplus boils down to an issue of basic economics: cost effectiveness. The bottom-line is that skimming medical surplus from the waste streamline would save hospitals money. How?

To realize the cost effectiveness of this recycling program, one much essentially visualize the normal waste stream flow which occurs on a daily basis. This normal volume of waste exiting the hospital includes a certain percentage volume of medical supplies that is discarded into those same "trash" bags. At OSUMC, the volume of such "mixed" waste is weighed in tons, and such volumes are recorded and tracked in annual tonnage and waste volume reports by the

waste management departments in the hospital. As per the waste removal trucking contract, the cost for pickup of outgoing waste from a hospital is determined based on the total tonnage being collected. In the case of OSU's University Hospital, there are additional fuel expenses and pickup surcharges for these trucks, which is a common feature paid by other waste management departments in Columbus hospitals. If, however, the volume of reusable materials were removed, the hospital would generate less outgoing tonnage to be trucked to the landfills. Reduced volumes of outgoing waste imply fewer trucking pickups from the hospital, which automatically means less fuel and pickup surcharge expenses for the hospital, too. But hospital savings would continue. The collection of medical surplus and its donation to nonprofit organizations is classified as a 501c3 record, which is tax deductible by the state of Ohio. Organizations such as MedWish International can even weigh, in tonnage, medical surplus donated by a hospital, and keep its inventory record of donated supplies throughout a year (also see example, Box 5).

Box 5: TopDawg Trucking Co.: An Example of Cost Savings

Trucking companies which service area hospitals, such as TopDawg Trucking Co. in Cleveland, OH, already has taken advantage of these tax deductable donations. Among their normal collection rounds within The Cleveland Clinic, they provide the service of delivering medical surplus generated at these hospital locations to MedWish as pro-bono work. In fact, they have recently opened a branch in the Columbus area. This offers the potential for TopDawg Trucking Co. to coordinate medical surplus donations from Columbus hospitals to MedWish International, in Cleveland, through normal commute routes of TopDawg trucks. In transporting medical supplies from Columbus to Cleveland in their trucks which would otherwise be empty, TopDawg Trucking would actually save money through their tax-deductible efforts while executing normal business operations.

Thus, removing medical surplus from the normal waste stream is cost effective for a hospital for two reasons: a smaller tonnage of waste generated equates to fewer trucking expenses, and donation of the medical surplus creates tax-deductable opportunities.

Reason Two: Hospital Recognition

Benefit number two for a hospital collecting medical supplies involves the hospital's own recognition for executing this enterprise. At an immediate local level, a hospital will automatically attract community acknowledgement for such an environmental and humanitarian effort. This increased publicity could effectively be superfluous; hospitals could gain media hype for their repurposing efforts through newspaper articles, medical newsletters, local radio and talk show discussions, hall council meetings, and local business advertisements alike. Even more convincing an argument is the fact that the hospital, itself, could promote its medical surplus collection program as a way to improve its local area ratings, and to encourage and attract residents to seek medical attention from their professional staff in the future. Instituting a medical surplus donation program would offer a tremendous community benefit for a hospital, as the increased publications and general communication about that hospital would enhance its repertoire within the local and surrounding communities.

Reason Three: Strengthens Partnerships among Community Hospitals

Organizing a regular collection route for medical surplus generated at a hospital encourages other medically-related facilities to do so as well. The benefit to this domino effect of joint hospital participation in collecting surplus within a local radius is the increased communication and networking among departments of various hospitals. Such relationships would encourage the exchange of other environmentally-friendly hospital practices, and more cost effective management ideas. These relationships could also present opportunities for hospitals to partner in community events. As a result, the increased communication among hospital departments creates an inter-hospital support network for trouble-shooting, brainstorming, and mutually beneficial relationships in the future. Thus, a hospital could benefit

from a medical surplus recycling program both with support from its local community and from other area hospitals.

Reason Four: Results in Other Recycling Efforts

A hospital's fourth most significant benefit from a medical recycling program is that the program encourages hospital employees to be more conscious of their ecological footprints and humanitarian responsibility. Because hospital personnel would become the "arms and legs" in implementing such a recycling program, their conscious efforts to reroute medical surplus from the mainstream trash could translate into the practice of other recycling habits, such as scrap paper and plastic repurposing. This could be particularly important for OSUMC due to the fact that its recycling programs for cardboards, plastics, paper, and aluminum cans actually generates a steady inflow of money in its current operation and management. Changing the daily hospital waste flow of reusable medical supplies involves a change in the lifestyles and mindsets of hospital employees; mindsets that are geared towards conscious awareness and conservation of resources could potentially prevent a significant amount of waste in a variety of areas within a hospital. This means the hospital saves money. Instituting a conscious collection for durable medical surplus could be achieved through education seminars and overall hospital encouragement, leading to changed work practices among hospital personnel and effectively saving hospital material expenses in the long term.

Reason Five: Response to Current Society

The next benefit to collecting medical surplus for a hospital involves a conscious cultural response to modernized society. As the pressure for "greener living" continues to permeate our society, so too will our nation and world push towards greener medical practices in the future. As OSUMC leads our nation with the next generation of healthcare professionals, it is their

responsibility, as well, to train Ohio State medical students to achieve their full potential humanitarian impacts. For Ohio State Medical School and Medical Center to maintain its reputable level of 'cutting edge' medical practices, the faculty members and administration must respond to current trends in our society, such as greener medical practices. Moreover, there may come a time when the federal government even mandates a baseline level of medical surplus repurposing; for a hospital to successfully adjust to such a situation, it is necessary that it operate "before the curve". Hospitals across our nation continuously struggle to balance their offerings of high quality medical services while still achieving efficiency and profit. The solution, however, to this problem simply manifests in this issue of medical surplus collection and its subsequent international donation. As divergence from the waste mainstream continues to grow in popularity and publicity, it becomes clearer that a high quality hospital is one that makes a difference both among our nation and in countries abroad.

Reason Six: Humanitarian Enterprise

Lastly, in transitioning to the grander scale, a hospital that contributes to international medical surplus donations makes a world of difference. After all, hospitals and medical clinics in developing countries are in dire need of basic medical supplies; these healthcare providers could readily use the surplus items generated in our American hospitals. So, if for no other reason, an American hospital should consider their medical surplus generation on the basis that "it's the right thing to do". If the mission statements of our hospitals and the medical oaths of our physicians are truly to "do no harm," we must stop neglecting the fact that durable medical product is unnecessarily put into our landfills on a daily basis. At the core of all medical providers, we certainly seek to raise the healthcare standards for peoples of all races in our

society. Offering medical supplies as a humanitarian effort is way to improve these same healthcare standards to peoples in other societies, too.

The reasons that a hospital should reclaim its medical surplus from mainstream waste are abundant and diverse. Teaching hospitals, such as Ohio State University Medical Center, may feel motivated by many of these previously discussed reasons to enact such a recycling venture; conversely, hospitals may only consider a single point. But failing to see at least one meaningful argument for the collection of reusable supplies only leaves a hospital ignorant and inert. Whether through the lens of an economical and pragmatic perspective, or through the humanitarian eyes of an empathizing developed nation, American hospitals have a lot to give.

Chapter 5: The Impact of One Individual's Quest to Reclaim Medical Surplus

For many hospital professionals, the working day is defined by scheduled meetings, hourly shifts, and the hum drum of daily routine. But for Dai Wei Lo, a registered nurse at Nationwide Children's Hospital in Columbus, Ohio, the work week involves up to ten additional hours devoted to "volunteer work," where dozens of hospital rounds are made to collect medical surplus amassed in various departments and floors of her hospital. Dai Wei Lo then takes the supplies to a property storage house owned by Nationwide Children's Hospital, where she individually unpacks, organizes, and takes an inventory of all the reusable medical items collected each week. Cramped and limited to only four bedroom-sized spaces, Lo must maintain an extremely organized system to mange the continuous inflow and outflow of reusable medical products within her storage house.

When she first began collecting at NCH, Lo only collected from hospital departments once a week, but now "there's a bag piled up daily in front of [her office] door so [she] must work everyday to take supplies to storage" (12). In just *10 months* of her individual medical surplus collection, **Dai Wei Lo has successfully accumulated a minimum value of $13,477.45 in medical products** (See Table 1).

The majority of Lo's collected medical surplus is redistributed to local physicians who request itemized lists for their individual, international medical mission work. For example, Lo regularly supports a physician living in the Democratic Republic of the Congo in Africa, funding him with particular items which are continuously needed for his work. In addition, she also routinely donates supplies to a Columbus church that supports a medical facility in Mexico. Lo thus experiences the high pressure to maintain available storage space for her collected supplies, yet remains driven to prove to her administrators that she is capable of managing such a project

in hopes of eventually being granted more storage space for her personal collection system.

Table 1 shows the personal inventory records of Lo's individual collection for the 10 months from June 2007-April 2008. The estimated unit values for each of the items have been extrapolated from a medical supplies cost value database provided by MedWish International. The quantity of product was then multiplied by its estimated unit price to generate a total product value which is reflected in the last column. It is important to remember, however, that the net total estimated value for medical supplies collected between June 2007-April 2008 is a *minimum* value because not all of the items collected by Lo could be found in the MedWish International database; such rows of supplies unidentified with a unit value have been deleted from Lo's inventory records.

The purposes of providing these data are multiple. First, it is to show that Lo's collection from various departments occurs on nearly a daily basis. Second, this inventory record is evidence that reusable medical product really does get generated in significant amounts and among a variety of departments. The list shows the variety and broad "usability" of the items that are collected. Note, for example, a box of 2-lumen CV catheter trays collected on 8/2/07 contributed a net worth of $1,690. That same day, 200 esophageal stethoscope and temperature sensors generated $1,500 worth of surplus at $7.50 a set. In other cases, the total cost value is overshadowed by the mind-blowing quantity of the specific medical product recovered; on 7/21/07, 1,400 syringe tip caps were retained from NCH's waste streamline (for all examples, see highlighted in Table 1). Finally, these data demonstrate the considerable value which exists in reusable medical surplus; a value which not only represents a price tag, but an incalculable humanitarian value for developing nations in need of such medical supplies.

The personal account for the collection of medical surplus items by Dai Wei Lo is an undeniable testimony that such a medical repurposing program both *can* and *should* be instituted at OSUMC and other Columbus hospitals. If the work of *one* woman in *one* hospital can manage to generate a minimum of nearly $13,500 estimated value in medical surplus items within less than *one* year, the potential for OSUMC to initiate a program is undeniable.

Table 1: Lo's Medical Surplus Inventory

Date	Contents	Quantity	Estimated Unit Value ($USD)	Estimated Total Value ($USD)
6/19/2007	Fr.6 suction kit	57pkg/box	1.55	88.35
6/21/2007	Fr. 6 suction kit	100pkg/box	1.55	155.00
6/20/2007	Fr.6 suction kit	65 Pkg/ box	1.55	100.75
8/20/2007///6/20/2008	Fr.6 suction kit	50Pkg/box	1.55	77.50
8/20/2007///6/20/2008	Fr.6 suction kit	50Pkg/box	1.55	77.50
8/20/2007///6/20/2008	Fr.6 suction kit	50Pkg/box	1.55	77.50
7/28/2007	Vent Humidifier	50 ct/box	2.00	100.00
6/19/2007///6/20/2008	Ambu bag syst No mask (Ped)	3sets /box	24.00	72.00
6/21/2007///6/20/2008	Ambu bag sys + mask (Ped)	7sets/ box	25.09	175.63
7/28/2007///6/20/2008	Ambu bag sys + mask (Ped)	4sets/ box	25.09	100.36
7/28/2007///6/20/2008	Ambu bag sys + mask (Ped)	6sets/ box	25.09	150.54
7/28/2007	Ambu bag sys + mask (Ped)	6sets/ box	25.09	150.54
6/20/2007	500ml Enteral pump delivery set	50/ box	1.00	50.00
6/21/2007	500ml/ 1000mi Enteral pump delivery set	500ml—21sets 1000ml—16set	1.00	37.00
6/21/2007	500ml Enteral pump delivery syst	50/box	1.00	50.00
6/21/2007	Reusable Nebulizer	10 kit/box—2 boxes		
7/21/2007	Abduction pillow SM	1/box	31.32	31.32
7/28/2008	SCD Sequel Tubing	4 sets		
7/28/2007	Diaper-- L	44ct/ box	0.54	23.76
7/28/2007	Diaper-- L	37ct/ box	0.54	19.98
7/28/2007	Diaper-- XS	72ct/ box	0.54	38.88
9/11/2007	Diaper--M	14	0.54	7.56
7/21/2007	Adolescent TCD stock	4/box Box 1		
7/21/2007	30cc syringe	100/box	0.47	4.70
7/21/2007	1ccsyringe+27G	400/box	0.47	188.00
7/21/2007	1cc syringe	450/box	0.35	157.50
8/4/2007	1cc syringe	400ct/box	0.35	140.00
8/4/2007	1cc syringe	400ct/box	0.35	140.00
7/21/2007	5cc syringe	250/box	0.14	35.00
8/4/2007	5cc syringe	200ct/Box	0.14	28.00
8/4/2007	5cc syringe	200ct/Box	0.14	28.00
7/21/2007	Syringe tip cap	1400/box	0.08	112.00
7/27/2007	2-lumnCVP cath tray 4.0x4		45.70	45.70
7/28/2007	Box 1—60cccath tip	76	0.08	6.08

Date	Contents	Quantity	Estimated Unit Value ($USD)	Estimated Total Value ($USD)
	Box 1A 60cc luer-lok	75	0.52	39.00
	Box 2 35cc Cath tip	20	0.08	1.60
	Box 3 30cc syringe	89	0.47	41.83
	Box 4 20cc syringe	77	0.28	21.56
	Box 5 10cc syringe	227	0.16	36.96
	Box 6 5cc syringe	531	0.14	74.34
	Box 7 3cc Syringe	236	0.25	59.00
	Box 8 1cc syringe	351	0.35	122.85
	Box 9 1cc syringe+ needle	251	0.32	80.32
	Box 10 10cc syringe+ Saline	75	0.28	21.00
	Box 11 needles 22Gx2bag 21Gx 1bag	22G—120 21G—60	0.38	68.40
7/28/2007	needles	21G—150	0.38	57.00
	Box 12 Rehabilitation	Belt x 4 Posey x2 Wrist R x 1	19.99 17.81 3.00	118.58
	Box 17 Uncuffed Endotracheal tube	3.5—6 4.0—4 4.5—5 5.0—7 6.0---4	35.00 35.00 35.00 35.00 38.00	922.00
8/4/2007	Box 18 Nasal cannulas Face Mask	 25 units 4 units	 11.67 0.19	292.51
8/4/2007	Box 19 Trach care+ Tubing	Fr. 6x7 Fr. 8x1	1.53	12.24
	Box 21A I.V. Tubing	27	2.91	78.57
	Box 21C Fluid Warmer	13	11.36	147.68
8/26/2007	Box 21E PCA ext set	34		
4/22/2008////6/20/2008	Box 22 I.V. Cath	24G—151 22G—55 20G—92 18 G—51 16G --45	1.12 1.21 1.21 1.21 1.21	438.95

Date	Contents	Quantity	Estimated Unit Value ($USD)	Estimated Total Value ($USD)
8/4/2007///6/20/2008	Box 23 Spinal needles	18 G-----1 20G------34 22G------48 25G-----9 26G------67	0.44 0.44 2.40 7.72 8.66	780.30
8/26/2007	Box 24 Bld Tranf dev F	50	0.58	29.00
////6/20/2008	Box 31 NG tube Feeding tube		22.00	22.00
8/4/2007	Box 32 Feeding Ext Set	98 units	1.70	166.6
9/4/2007	Box 34 A 500cc enternal pump delivery set		1.00	1.00
9/4/2007	Box 34B 1000cc enternal pump		1.00	1.00
9/4/2007	Box 36 Defib-Pads		20.55	20.55
9/4/2007	Box 37 Red-dot EKG Electrode		0.54	1.08
8/26/2007	Box 41 A Sel cath M	Fr. 12 X 1box +24u(50u/box) Cath+bag X1b 30u/box	1.04	76.96
8/26/2007	Box 42 Urine specimen ct U-Bag	9 4b+9u	1.60	28.80
10/15/2007////6/20/2008	Box 43 Surgical suture		20.00	20.00
10/15/2007	Box44—A2 Surgical gown		6.00	6.00
10/15/2007	Box44-B1 Surgical Drapes		5.00	5.00
10/15/2007	Box44-B2 Surgical Drapes		5.00	5.00
9/11/2007///6/20/2008	Box52A BP cuff Adult		12.60	12.60
9/11/2007///6/20/2008	Box52B BP cuff Adult L	8	12.60	100.80
9/11/2007///6/20/2008	Box52C BP cuff Adult S		12.60	12.60
9/11/2007///6/20/2008	Box52D BP cuff Child	10	12.60	126.00
9/11/2007///6/20/2008	Box52E BP cuff Infant		11.55	11.55
9/11/2007	Box55		1.25	1.25

Date	Contents	Quantity	Estimated Unit Value ($USD)	Estimated Total Value ($USD)
7/28/2008	T-connector Ext	80ct/box	1.68	134.40
7/27/2007	2-lum cvp cath tray Radial Artery. Cath tray	CVP FR 4.0x4 Ra. Art. Fr3.0x3	45.70	182.80
	CVCath Kit 2-lum CV Cath kit	Ga 16x4 Ga22x10 Fr. 4.0x1	20.00 20.00 45.7	325.70
	2-lum CVP cath kit Multi-lum CVP Cath kit CV Cath kit	Fr.4.0x5 Fr.5.5x2 Ga16x3	45.70 101.90 20.00	492.30
	CV Cath Tray	Fr. 4.0x7	2.78	19.46
	Tray Femoral 2-lum Cvp Tray	CVP Fr.5.0x1 Fr. 6.0x2	45.70 45.70	137.10
	CV Cath tray	Fr.4.0x4 Fr.5.0x1 Fr.6.0x1	2.78 2.78 2.78	16.68
8/2/2007	2-Lumen CV Cath Tray	Fr. 4.0x 25 Fr. 5.0x12	45.70 45.70	1690.90
8/4/2007	CVP kit 2-Lumen cvp tray CVP cath set	Ga16x3 Fr.4.0x3 Fr.6.0x1 Ga22x2	19.94 45.70 19.94 19.94	256.74
8/4/2007	Cvp cath set Radial A-line 1-Lumen Catheter Sheath intr kit	Ga 22x3 Fr. 3.0x5 Fr.2.5x2 Fr.2.7x4 Fr. 8.5x1	19.94 45.70 27.28	269.90
8/4/2007	Cont Epid tray Exchange Transfusion set Neonat procedure tray	3 units 3 units 1 unit	27.74	83.22
9/4/2007	Cont Epidural tray	12set /box	27.74	332.88
8/2/2007	Esophageal Stethoscope + Temp sensor	Fr. 18 x25/box x 8 units=200	7.50	1500.00
8/4/2007	Oral Cleaning & Suction syst	5 ct/box	20.00	100.00
	Ambu bag+ mask In Can	27	25.00	675.00
10/4/2007	Box B-1 Diaper XS		0.54	0.54
10/4/2007	Box B-2 Diaper S		0.54	0.54
10/4/2007	Box B-3 Diaper M		0.54	0.54
10/4/2007	Box B-4 Diaper L 40-60lb		0.54	0.54
10/4/2007	Box B-5		0.54	0.54

Date	Contents	Quantity	Estimated Unit Value ($USD)	Estimated Total Value ($USD)
10/4/2007	Box F-1 Dressing 4x4		5.02	5.02
10/4/2007	Box F-2 Dressing 2x2		3.82	3.82
4/18/08	EKG Tape	22	3.00	66.00
4/18/08	IV Labeling tape	20 boxes, 190 loose	2.00	420.00
				Minimum Grand Total Collected between June 2007-April 2008: $13,477.45

Chapter 6: What the Rest of the World is Really Like

In an effort to gain a clearer understanding for typical healthcare standards of developing nations, I approached research for this topic in two ways. My major source for information was through a first-hand experience as a medical intern at Iganga District Hospital in Iganga, Uganda. Living for a month with a hospital nurse, I shadowed physicians, administered treatment, helped deliver babies (see Figure 3), observed surgeries, and performed diagnostic testing in the laboratory of this government hospital. But having seen the stark need for medical supplies as a personal testimony, I also wanted to gain insight into another part of the world. In my second approach to learn about how healthcare within developing nations really operates, I audited a meeting at MedWish International involving Kathy Tschiegg, who is the director and founder of Central American Medical Outreach, Inc. (CAMO). Her descriptions of personal experiences within Honduran hospital facilities provided this additional resource in understanding medical standards in third world nations, which I could compare and contrast to what I saw in Uganda.

Figure 3: Delivery Room at Iganga District Hospital, Uganda. 8.5.08. Photo by Anne Duchene

Iganga, Uganda

I remember so clearly how that twelve year old girl lay on the dilapidated foam mattress, wrists pronated and limp, with an IV tube that dangled from its hook between two window slats

of Iganga District Hospital in Uganda (see Figure 4). She had survived an intestinal blockage, but was suffering from severe dehydration and a blood infection called septicemia. I had gotten to work early that morning and overheard a few nurses mention that this girl was the weakest in the female ward, had just arrived from a distant village, and how her mother had barely enough shillings to buy some matooke (plantain bananas) and tea. That was the point when some instinctual urge hit me inside at my core. In that moment, sudden thoughts blurted across my brain; *what medicines does she need? Whatever they are, I'll just go buy them myself.* And for a mere fifteen American dollars and three intense days in the admittance ward, I was able to provide this mother the lively daughter that she had always known. It is these life experiences that have culminated my innate desires to pursue a medical surplus collection program among local Columbus hospitals for those people who are under-served and under-supplied in communities abroad. Instances such as this one presented themselves many times in my month-long medical internship in Uganda, Africa this past summer.

Figure 4: Girl in Female Ward, Iganga, Uganda. 8.17.08. Photo by Nurse Michael

From the very first day I arrived in Iganga, Uganda, I observed how dramatically different were the hospital and its healthcare needs in comparison to a typical American one. In place of sparkling white tiled floors were concrete ones covered with woven floor mats. And in place of the common cold were healthcare needs defined by tropical diseases, HIV/AIDS, and advanced cases of TB, pneumonia, and even tetanus. Corralled among a single room, admitted patients lay silently on the bed sheets they had brought from home within each window-

ventilated ward in the district hospital. Funded and supplied by the government, patients typically commuted to this hospital from their respective villages to receive 'free' medical attention. 'Free' to pay their own IV bags, antibiotics, and surgical supply expenses. 'Free' to have one of five total doctors in the hospital examine them for up to ten minutes a day without latex gloves. 'Free' to have their family members bring them food to sustain them through the duration of their admittance in the hospital. And, finally, 'free' to have all the other patients in the ward watch them exposed and examined, watch them eat and sleep, and listen to their diagnoses from the physician.

This hospital typically receives its most basic medical supplies such as gauze, latex gloves, cannulars, IV bags, and syringes on Monday shipments from the government. However, in the four weeks I spent in Iganga District Hospital, no shipments were ever received. Conveniently placed dispensaries were thus where patients and their family members were sent to purchase such medical needs. Essentially the bulk of what little supplies did exist at the hospital were items which were brought and donated from volunteers from the UK and Australia, who were working in the hospital at the same time I was there. Two Australian ladies, for example, even brought the hospital its first electrocardiogram, an expensive device that "tracks the overall rhythm of the heart and weaknesses in different parts of the heart muscle;" a typical American hospital probably has dozens of these alone, merely because "it is the best way to measure and diagnose abnormal rhythms of the heart" (20). Physicians and professional medical staff alike can truly attest to the importance of this device for any standard hospital.

Bags and bags of donated medical samples, catheter tubes, and bandages filled the storage shelves of the hospital wards throughout the duration of my stay from the muzungu ("white skinned") volunteers. The problem was, much of it was mysteriously "used up" over the

span of a weekend. Large quantities of medical supplies were rumored to have been sold off by some nurses for a personal profit. But before any judgments are made, I challenge my readers here to think about life from a Ugandan nurse's perspective for a moment. The average married Ugandan woman is extremely poor, living on rice and beans, and, on average, has seven children. She hasn't been paid her working wages from the government in four months, and doesn't have enough money for a savings account at the bank; money is *scarce* for her and her family. Now imagine that one of her children acquires malaria, where "Malaria is the leading cause of illness and death in Uganda, accounting for 25-40% of all outpatient visits at healthcare facilities" (13). In her despair, she sells off one box of latex gloves to be able to provide quinine treatment for her child to overcome the disease. Now my question is this: What mother, American or Ugandan, would not do whatever it took to save the life of her child? I talked much about this struggle to balance the medical needs of this district hospital with my host mom, Sister Baruka Rose. It seems there is a cultural miscommunication wherein volunteers want to immediately donate their medical supplies without registering them with the hospital administration or nursing staff to be logged and recorded. Meanwhile, Ugandan hospital staff doesn't want to offend the muzungo volunteers in telling them where exactly to allocate the supplies because they are happy to receive them at all. Furthermore they respect the muzugus in determining where they want to give their surplus on account of because it belongs to the white-skinned in the first place (see Box 6).

Box 6: Surplus Donations are Regulated

As it turns out, large medical donations, registered through organizations such as MedWish International, are not given haphazardly to hospitals in need of supplies; an application process with particular guidelines and standards for a hospital to receive medical supplies is reviewed by MedWish International in an effective manner which will be discussed later.

Due to my ability to be mobile within the district hospital, I had an opportunity to observe the specific medical supply needs tailored to individual wards, and among each department of the hospital I experienced at least one, if not multiple, instances wherein a scarcity in basic medical supplies was compromising to the level of healthcare administered. I became fascinated with the maternity ward, where I was interested in reasons as to why infant and maternal mortality rates are 98 per 1,000 babies and 400 per 100,000 births, respectively; consequently, I spent a large amount of my days observing midwives in the delivery room where the factors that contribute to these high statistical numbers began to surface. To begin, there was not a single infant incubator in the entire hospital; newborn babies were bundled in sheets and blankets, and set on a counter ledge near a window. I witnessed a delivery of a fetal abnormality called gastroschisis, which is a condition in which a large portion of the intestines are exposed on the outside of the abdominal cavity due to an inefficient closure of the abdomen during fetal development. Such cases are present even in American hospitals, but it poses an extreme risk for contamination and infection for the infant if the newborn is not placed in a sterile environment immediately following delivery. Due to a lack of emergency medicine and an incubator altogether, the mother of this particular child was going to need to hire a private taxi to transport her newborn to a better-equipped hospital in Kampala, the capital city over two hours away from Iganga. I never heard if this woman was able to provide enough money for such transportation; the last I saw of

Figure 5: "Give me a silly face". Orphans in Iganga, Uganda. 8.10.08. Photo by L. Thornhill

this infant was the yellow bed sheet that bundled him atop the counter space near the delivery room window.

I remember an equally striking situation in the maternity ward involving a shortage of lidocaine, which is a numbing agent for post-delivery suturing for torn mothers. There seemed to be some confusion in the delivery room immediately following one mother's delivery, as Sister Joy and some other midwives were speaking rapidly in their native Lugandan language. Once up to speed, I learned the ward had expired its supply of lidocaine, but the midwife was to proceed with the stitching accordingly. My presence in the maternity ward at this point allowed me to convince these nurses to delay their suturing until I could return with a fresh bottle. As it turns out, one US dollar is enough to supply dozens of women ample amounts of this numbing agent for more comfortable, and arguably more humane, post-delivery suturing. Perhaps it was mere luck that I stumbled into the maternity ward at that point, able and willing to provide such a resource in stark shortage. But from my experiences in sum, the assumption that such raw suturing occurs on a regular basis is a fairly accurate and honest picture.

Cancer therapy is essentially nonexistent in Iganga District Hospital, and for two good reasons: there is no ultra sound or MRI equipment for diagnostic purposes, and there are no drug therapy supplies. I remember discussing one patient's bulging liver due to the accumulation of a large hepatic carcinoma. According to Dr. Jude, she 'would probably just die' of an opportunistic pathogen infection due to her immuno-compromised condition. This conversation was a day or two after I had witnessed a nurse be instructed to collect blood without a pair of latex gloves from a patient known to be infected with the HIV virus. The next week, I observed various surgeries and cesarean sections as patients lay on the operating bed under anesthesia with nothing but the IV tube connected into their cannulars. There were no heart rate monitors, no

blood pressure machines. There was *nothing* to track *any* bodily function, except the visual scan of the anesthesiologist in tune to physical movements to indicate that the patient needed more anesthetic. I also spent time with a nutritionist, and held a set of one-year-old twin girls who collectively weighed 13 kilograms (that equates to *28.6 pounds*). I listened to the nutritionist limit these children to one nutty bar a piece until they could return to the hospital in three days. The list of these supply shortage experiences continues indefinitely. *But what was merely a thirty day experience for me continues indefinitely for the physicians and the medical personnel at Iganga District Hospital.*

The need for medical surplus from hospitals that generate such re-usable materials is undeniable. Yet, my experience in Uganda represents only a single hospital in a single town of a developing country. Situations such as these exist all around our world. And, in one of my meetings with MedWish International, I was able to hear the testimony of a woman coordinating medical surplus donations with a partnership hospital in Honduras.

CAMO Meeting with Kathy Tschiegg, Cleveland, OH

Kathy Tschiegg, RN, BBA, and founder of a nonprofit organization called Central American Medical Outreach, Inc. (CAMO), spoke of her experiences in third-world communities, her passion to orchestrate sustainable development, and her vision of raising awareness for the international need of American medical surplus. Throughout 2007, her organization provided 143,000 services traced back to 9,000 patients, serving 123 public health groups in Honduras alone. Between her two-tiered organization base in Orrville, OH and Barrio El Calvario Santo Rosa de Copán, Honduras, Tschiegg spends her years in transit between the two nations. In shying away from an old view of hand-carrying "band-aid brigades," Tschiegg

expressed the importance for an organization to create a needs assessment of the hospitals and medical clinics receiving medical surplus donations. CAMO seeks to understand the infrastructure capacity for a healthcare provider in the developing communities. As with any hospital, there is the huge issue of storage space for supplies, and failing to take space issues into account only creates "biomedical doorstops" for an over-donation of medical surplus items. Tschiegg is adamant about not taking 'junk' down to the communities that CAMO serves in Latin America; in fact, she has "rotary clubs that hate [her] guts" because "they want to sponsor a container but they want to fill it up [without knowing the hospital's needs or infrastructure]" (21). Operating on a $380,000 annual budget, CAMO organizes the transport of freight boxes from Indiana to Miami, FL, a process costing $1800-$2800. The boxes are then loaded into 48' sea containers, which can contain up to 300,000 pounds of medical supplies and are shipped to communities in Honduras for $2-3,000 each depending upon the season and the fluctuating cost of fuel. CAMO also employs forty Hondurans among the clinics they serve in order to maintain counterparts in the local community who can identify their hospital's needs in the area. In one community, CAMO has instituted a "social investment" in which donated medical products that cannot be used by the particular health clinic are sold on the local market for a profit that is invested back into the normal operations of the Honduran hospital (21).

Tschiegg continuously insisted that medical surplus generated in American hospitals has a "common sense expiration date" wherein anything injected intravenously such as epinephrine bottles in spinal trays do, in fact, expire, but endotrachial tubes, gloves, gauze, IV caths, nylons for suturing, and lap sponges are "alright", "don't expire", or "can be autoclaved" regardless of their "official" expiration dates (21). In essence, she asserted that discarding these items in American waste streams is "making usable products not usable" (21). Tschiegg then recounted a

personal experience with a shortage in basic medical supplies in a Honduran hospital. She recalled a night shift in which she encountered two patients in respiratory distress: a forty-year old leukemia patient, who had previously survived a heart attack, and a newborn infant. With a single oxygen tank and only one plastic tube, both patients would not be able to survive the scarcity of resources. In response, Tschiegg removed the ear pieces and diaphragm of her stethoscope, connected one end of tubing to the oxygen tank and split the flow between the two patients by inserting the Y-branched stethoscope body into one nostril of each patient. Her testimony for the medical supply needs of developing communities was riveting; "[We] had to stop surgery for three months in Honduras because we had no anesthesia" (21).

An international donation of medical surplus is not simply romantic idealism of spreading world love and peace. Donations of medical surplus must exist on an itemized medical list request basis. And while the average American can often identify the official language of a nation overseas, rarely do we understand or recognize the healthcare standards and medical needs of these countries. For many Americans, a country is a country defined by its geographical boundaries and political system. Yet, a more discerning glance defines a country by its people and society, and when we fail to identify the healthcare needs of those abroad, we effectively discount the essence of the people. Eventually, that developing nation fades as a blip on our humanitarian radars.

Chapter 7: Organizations Responding to Medical Surplus

***MedWish International*: Saving Lives, Saving the Environment**

MedWish International is a nonprofit organization based near Cleveland, Ohio, which has collected surplus medical supplies and medical equipment from surrounding community hospitals for the last fourteen years. With Tish Dahlby leading as Executive Director, MedWish International amasses a majority of surplus gauze, gloves, components of surgical packs, and other medical product deemed "expired" or "unsanitary." These materials are collected from various branches of The Cleveland Clinic, Brother's Brother Foundation, Spectrum Surgical, TopDawg Trucking, and other participating hospitals. In addition to durable medical supplies, medical equipment, such as dialysis and ultrasound machines, is also accepted at MedWish. According to Dahlby, the guaranteed sterility dates on medical supplies ranging from catheter kits to cotton balls "are essentially marketing ploys" (18). With a limited full-time staff only consuming 1.5% of the total expenses budget, MedWish is able to organize and inventory their high volume of medical product with the help of an extensive community of volunteers. According to their 2007 annual report, volunteers logged a total of 4,800 hours that year, which is "the equivalent of two full-time employees and one part-time employee" (18).

Once rescued and sorted, MedWish International donates reusable materials to dozens of recipient organizations, including an ongoing partnership in Honduras, translated as "Society of Children." In 2007, MedWish International collected 205,000 pounds of donations, which provided "assistance for 115 humanitarian aid projects in thirty-five countries" (18). While the 2008 annual report has yet to be released, MedWish International anticipated collecting close to 400,000 pounds from hospitals in northeastern Ohio *alone*. This anticipated influx in collection is the result of increased hospital and manufacturing company participation in MedWish

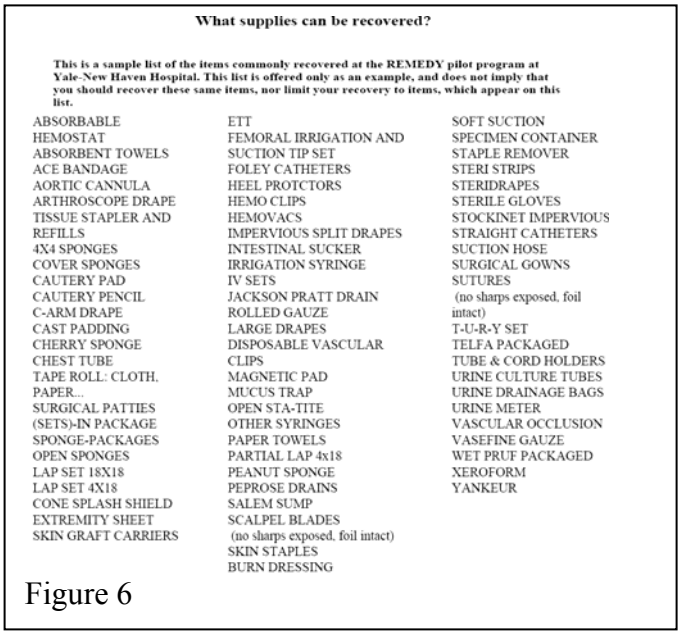
International, which achieves its financial funding through national grants and corporate donations. In addition to international supplies donations, MedWish International offers global medical mission teams of physicians, nurses, dentists, and non-medical volunteers to "more remote areas [in Honduras] that are less served by other international charity organizations" (18). The success and rapid expansion of this organization over the last five years can be attributed to increased awareness for the diversion of medical surplus, and MedWish International's demonstrated achievement in managing such an enterprise with integrity and efficiency.

As OSUMC and other Columbus hospitals explore medical surplus diversion plans, a partnership with MedWish International should be an immediate consideration. Should grant money be awarded for a MedWish International branch in Columbus, Ohio, the logistics and reality of enacting this environmental and humanitarian project could be achieved. As a Cleveland-based organization, MedWish International serves as a model solution for such initiatives among Columbus-area hospitals. Other initiatives across the country also serve as potential models. For example, the operating room medical staff at Yale-New Haven Hospital in New Haven, Connecticut also operates a potential solution to the diversion and long-term management of medical supplies generated in Columbus hospitals.

Remedy: Recovered Medical Equipment for the Developing World

In 1991, Dr. Will Rosenblatt founded a nonprofit organization called *Remedy, Recovered Medical Equipment for the Developing World*, specifically committed to rerouting medical surplus generated in operating rooms. Dr. Rosenblatt and several of his OR staff at Yale-New Haven Hospital have produced a non-contractual training guide for any hospital, nationwide, interested in beginning a repurposing program for surplus medical items and equipment. Within

Remedy's thirty-four page In-Service Teaching Manual, a hospital administrative staff can learn about suggested recycling protocols, surplus diversion flowcharts, recommended collection organizations, and keys to managing a database inventory of supplies. Because Dr. Rosenblatt and his team of OR surgeons have been so successful at Yale-New Haven Hospital, this In-Service Training Guide can be requested free of charge from their home website, www.remedy.org. Unlike MedWish International, Remedy is *not* a collection agency for medical items generated in Columbus hospitals, but merely a guideline for hospitals that are new to diversion programs. Figure 6, extracted from Remedy's In-Service Training Manual, is a list of suggested recoverable, OR items for hospitals beginning to identify their potential in repurposing medical surplus for international needs. (Note that a complimentary, department-wide list of reusable medical items provided by MedWish International can also be found at www.medwish.org.) Because volunteers of the Remedy program are committed and passionate for their cause, they are eager to answer logistics and assessment questions for start-up hospital programs, provide advice for the management of these long-term repurposing programs, and aid in trouble shooting obstacles of this recycling program spanning employee training to identification of collection organizations. As OSUMC continues to move towards greener medical practices, such an informative and available organization as Remedy should be considered in creating the framework for a successful medical surplus diversion program.



What supplies can be recovered?

This is a sample list of the items commonly recovered at the REMEDY pilot program at Yale-New Haven Hospital. This list is offered only as an example, and does not imply that you should recover these same items, nor limit your recovery to items, which appear on this list.

ABSORBABLE HEMOSTAT
ABSORBENT TOWELS
ACE BANDAGE
AORTIC CANNULA
ARTHROSCOPE DRAPE
TISSUE STAPLER AND REFILLS
4X4 SPONGES
COVER SPONGES
CAUTERY PAD
CAUTERY PENCIL
C-ARM DRAPE
CAST PADDING
CHERRY SPONGE
CHEST TUBE
TAPE ROLL: CLOTH, PAPER...
SURGICAL PATTIES (SETS)-IN PACKAGE
SPONGE-PACKAGES
OPEN SPONGES
LAP SET 18X18
LAP SET 4X18
CONE SPLASH SHIELD
EXTREMITY SHEET
SKIN GRAFT CARRIERS
ETT
FEMORAL IRRIGATION AND SUCTION TIP SET
FOLEY CATHETERS
HEEL PROTCTORS
HEMO CLIPS
HEMOVACS
IMPERVIOUS SPLIT DRAPES
INTESTINAL SUCKER
IRRIGATION SYRINGE
IV SETS
JACKSON PRATT DRAIN
ROLLED GAUZE
LARGE DRAPES
DISPOSABLE VASCULAR CLIPS
MAGNETIC PAD
MUCUS TRAP
OPEN STA-TITE
OTHER SYRINGES
PAPER TOWELS
PARTIAL LAP 4x18
PEANUT SPONGE
PEPROSE DRAINS
SALEM SUMP
SCALPEL BLADES (no sharps exposed, foil intact)
SKIN STAPLES
BURN DRESSING
SOFT SUCTION
SPECIMEN CONTAINER
STAPLE REMOVER
STERI STRIPS
STERIDRAPES
STERILE GLOVES
STOCKINET IMPERVIOUS
STRAIGHT CATHETERS
SUCTION HOSE
SURGICAL GOWNS
SUTURES (no sharps exposed, foil intact)
T-U-R-Y SET
TELFA PACKAGED
TUBE & CORD HOLDERS
URINE CULTURE TUBES
URINE DRAINAGE BAGS
URINE METER
VASCULAR OCCLUSION
VASEFINE GAUZE
WET PRUF PACKAGED
XEROFORM
YANKEUR

Figure 6

Chapter 8: A Plan to Divert Medical Surplus from the Waste Streamline

A Process Involving 5 Simple Steps

While it may be easy to identify the sources of medical surplus generation in a hospital, it is an entirely different task to determine how this durable product could be deflected from the waste streamline. Understanding the flow of the different waste streamlines involves the coordination of several departments within a hospital, from the purchasing and distribution branch to each department nursing staff on the floors; each area has a particular responsibility in order coordinate this repurposing project. Discussed below are insights from my research experience to execute this recycling program in five key steps.

Step One: Designing Uniform Waste Streams

Before the collection of medical surplus can begin, a hospital must institute a uniform scheme of color-designated trash bags, and collection bins of consistent size and shape. As a model for the successful disposal of designated items into their respective receptacles, Licking Memorial Hospital in Newark, Ohio uses a color coded system in their trash bags for each waste stream. For example in this hospital, clear trash bags are used for regular solid waste, red bags designate biohazardous materials, yellow bags collect hazardous waste, and blue bags are used for surplus towels and laundry materials. It is important that such color schemes are consistent throughout the hospital so that employees maintain the correct disposal of their wastes into appropriate waste streams, and so that the hospital itself can minimize collection costs. Biohazardous waste, for example, presents a more expensive contract for collection than landfill solid waste (see Chapter 3), and items not needed to be discarded into red biohazardous waste directly increase the collection costs for a hospital from a simple misplacement of materials into

the wrong waste stream. It is also important to note that solid waste should be collected in clear trash bags so that items which do not belong in this waste stream can be easily identified and corrected; such a simple switch within the purchasing department of a hospital can have a tremendous benefit for the management of waste streamlines and the divergence of medical surplus items generated in a hospital.

Step Two: Using the Automated Transport System and Creating a Database

The next step for collection of medical surplus is the introduction of appropriate collection bins specifically designated for reusable medical materials. Such bins must be located in strategic locations within a hospital, where high volumes of medical materials are used on a daily basis. Based on waste assessment tours throughout the different hospital departments, the most logical and efficient placement of these particular surplus bins should be located within each operating room, procedure room, and a central location in each nursing ward, such as the staff lounge or break room. High volume procedure rooms include radiology units, the dialysis center, neonatal units, intensive care units, cardiac units, and the dental department. In fact, at Nationwide Children's Hospital in Columbus, Ohio, Dai Wei Lo has created such designated collection receptacles and is collecting medical surplus from her boxes in all of these locations in her hospital, in addition to central supply and purchasing, outpatient center, rehabilitation center and home care unit.

Fortunately, OSU Medical Center already has a means to collect these medical surplus receptacles through its robotically-controlled Automated Transport System (ATS) which maintains collection and replenishment of biohazardous bins, trash receptacles, and deliveries for all the floors and departments within the hospital. Thus, introducing new routes and additional collection bin targets is simply a matter of electronic programming, which is managed by the

Environmental Department within University Hospital. In fact, it has been estimated that this multi-million dollar project installed only a few years ago is only currently working at 30% of its maximum capacity (3). University Hospital, therefore, possess the materials and potential to make a significant collection effort, without introducing additional labor costs associated with transporting the surplus items from high volume procedure areas to the ground floor of the hospital. The ATS could literally help to do a world of good.

A second component to instituting collection receptacles involves a computer programming data tool to create rate records of medical surplus averted from solid and biohazardous waste streams. The rates for these tracking records are necessary for a hospital to compare the amount of reclaimed goods from year to year within a hospital, in addition to providing a common metric of durable product entering a repurposing program for hospitals to rank and compare relative successfulness among local area hospitals. For example, a rate defined as part of this tracking tool could be expressed as the poundage of medical surplus salvaged in a hospital per month. Another rate could be the cost value for medical surplus per poundage. Organizations such as MedWish International can help a hospital keep inventory records of medical surplus rates when products are initially weighed, sorted, and valued at their storage location in Cleveland, Ohio. Such reports are already documented for tax deductable purposes, but it is essential that a hospital maintain its collection records in-house with a data tracking tool just as it regularly tracks volumes and expenses related to solid waste streams, biohazardous streamlines, and other resource recycling programs. An example of how an Environmental or Materials Systems Department of a hospital could begin recording medical surplus recovery rates is shown in the excel diagram in Figure 7, provided by an organization called Practice Greenhealth, located at http://www.practicegreenhealth.org/.

Figure 7: Examples of Data Collection Templates

E.2 – C RECYCLING WORKSHEET COLLECTION WORKSHEET DATE:

Determining Costs Per Material

Material: ____________________ DATE: ____________________

A Date of Pick-up	B Weight. (lbs)	C Pick-up Haul Fees	D Processing Fee	E Container .ental/Lease Fees	F Total Costs (C+D+E)	G Revenue	H Total (Cost) Revenue (F+G)	I *Cost of Disposal (for comparison)
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
		$( )	$( )	$( )	$( )	$	$	$( )
***TOTAL/ MO**		$( )	$( )	$( )	$( )	$	$	$( )
Annualize (tons/year)		$( )	$( )	$( )	$( )	$	$	$( )

*Continue for entire month

* For example, if you were disposing of this material as solid waste, use landfill tipping fee and compare disposal costs to recycling costs/revenue.

SOLID WASTE WORKSHEET DATE: ____________________

A Location	B Container Type And Size	C Haul Schedule (See Table)	D Hauls Per Yr	E Cost Per Haul	F Total Haul Cost (D X E)	G Avg. Wt. Per Haul (lbs)	H Annual Weight Tons/Yr	I Tipping Fee/Ton*	J Total Tipping Cost (H X I)	K Other Costs	L Annual Cost (G+J+K)
					$	$		$		$	$
					$	$		$		$	$
					$	$		$		$	$
					$	$		$		$	$
					$	$		$		$	$
					$	$		$		$	$
					$	$		$		$	$
					$	$		$		$	$
TOTALS					$			$		$	$

Instructions for Completing Worksheet

1. Location/Container Size
   - List primary container first
   - Specify type and size and average weight per Haul

2. Hauling Schedule
   - The purpose of understanding haul schedules is to assess opportunities to reduce costs. Ask the following questions for each container:
     - Are the containers going out full?
     - Can you monitor fullness of containers and have the ability to minimize the number of hauls per month?
     - Is the container the appropriate size?
     - Can you alter the schedule to maximize the load and therefore reduce hauling costs?

3. Determine Weight: Average Weight Per Haul and Annual Weight
   - Actual weights are better but if you are being charged by the container and not the weight, please clarify and estimate weight.
   - Calculate annual tons by estimation (D x G) or total actual tare slips.

4. Costs
   - Tipping Fees: the per ton fees charged at the disposal site.
   - *If you are charged by the container or have a set hauling fee, then a Tipping Fee may not apply. In this case, your total cost might be the "Total Haul Cost."
   - Other Costs: might include other transportation fees, or container lease or rental fees. Use annual costs.

Step Three: Locating a Medical Surplus Storage Space

Thirdly, a community of hospitals must establish a common, community storage building to house the medical surplus that accumulates in sporadic quantities and product type. Because storage space within a typical hospital is extremely scarce, a waste management department is reasonably limited to two or three skids, each with 48"x48"x72" available space for medical surplus collection. Therefore, a collection center separately located from the hospital must be identified in order to provide a surplus-collecting institution the necessary security that this type of program can be managed and maintained for the long term. MedWish International, for example, acts as this identified storage base for medical surplus generated at The Cleveland Clinic, as this hospital rents a separate operations building to the nonprofit organization for $1 a year. Because The Cleveland Clinic allots this building for nonprofit collection of medical surplus, a convenient, local "home base" is easily accessible to TopDawg Co. transport trucks from the Clinic locations, in addition to other surrounding hospitals and longer distance networks of Ohio that can take advantage of this storage space. A collection base within the Columbus area similar to the one in Cleveland is essential for the efficient coordination of durable medical supplies to persist apart from the mainstream waste flow in individual hospitals. Such a collection space is currently being investigated for Central Ohio Hospitals, with a particular

interest in vacant space of a building owned by Mt. Carmel Hospital in Columbus, Ohio. Once a storage space can be identified and secured with the Columbus area, medical supplies that accumulate from Columbus hospitals could then be transported to sorting and redistributing agencies such as MedWish International in Cleveland, Ohio.

Step Four: Trucking from Point A to B

The next logistical step in this process of managing the waste stream of durable medical supplies is a routine and dependable trucking route that can transport medical supplies from identified hospital centers which are collecting surplus product on a regular basis. The most efficient means to do this local area collection would require a designated pick up schedule throughout the month. For instance, pickups could be coordinated between hospitals of the "Big Three" Columbus associations, including Mt. Carmel, OSUMC, and Ohio Health locations, on the first and third Tuesday of every month. It is important for a schedule to be established and maintained so that hospitals have a secure sense that storage space for durable medical product will always be replenished and will not exceed available capacities. Such a pickup coordination would be best established in a contract with a local area trucking company, such as TopDawg Trucking Co. instead of relying on individual hospitals to be responsible for their own transport to the local storage space available. Whether or not such a pro-bono agreement could be instituted among Columbus hospitals is a contract that would require extensive negotiation and coordination with hospitals on board for this recycling program approach.

Step Five: Employee Training and Raising Awareness

A final step in instituting an efficient and longstanding repurposing collection program among Columbus hospitals involves raising awareness for this cause. Conscious diversion efforts of medical surplus from mainstream waste would involve a conscious change in mindset

for medical professionals and hospital employees. "Before jumping into a green project, hospitals must develop a comprehensive green plan that starts with support in the boardroom and executive leadership, is directed by a sustainability coordinator and is supported by smaller groups of 'green teams' or individual champions throughout their facilities. Finally, a high-level executive should regularly report to the CEO on system wide green initiatives […] having the right strategy in place from the highest levels of leadership is critical to the success of any green program (20)." Such a raised awareness for the local, short-term and international, long-term benefits of medical surplus diversion would be essential to coordinating a successful repurposing program. Employees need to understand *why* they should make the conscious effort. "The gap in the knowledge of the environmental impacts of health care products and services underscores the need for increased understanding among health professionals of the integral links between human health and environmental health." As one resource states, "environmental information should be integrated into the education of health care professionals to match the changing trends in disease and illness and to increase their consciousness of appropriate use and disposal of resources (18)." And educating tools can manifest in multiple forms.

Hospital network emails and newsletter articles, appropriate signage above collection receptacles and informational packets about the medical surplus collection program are all simple ways a hospital can promote awareness and involvement into medical surplus collection. In addition, training seminars for the directors of all procedure departments and nursing units would be essential to educate and motivate hospital employees to invest their efforts into this environmental and humanitarian cause. "Nurses are essential in making the program successful" because they are the active decision makers as to where items are discarded during patient procedures and upon patient discharge from their recovery rooms (22). Area wide seminars and

presentations given to various hospital organizations through The Association for Healthcare Resource & Materials Management (AHRMM) meetings would be very effective outreach programs to spread understanding and responsiveness to this project among the broader community. Such a momentous change in mindset and conscious recycling practices are bound to take some time as increasing numbers of employees overcome the learning curve. However, basic awareness such as lists of permissible items on signs above repurposing bins is a simple beginning step that is essential to creating a broader scope of awareness and collection. Regulation and personal training for this collection project could even be integrated into routine safety rounds among hospital floors to ensure that healthcare employees are recycling medical items properly. Raising awareness for medical surplus collection could have an avalanche effect; a small scale effort to spread knowledge on this particular issue could have a tremendously resounding effect on our local communities and in developing countries abroad as more hospitals find the value in instituting such a beneficial agenda.

In summary, from a Columbus hospital's perspective, the main logistical breakthroughs are essentially confined to the daily operations within the hospital itself. These responsibilities include uniform waste streamlines, collection and transport of medical supplies from the procedure floors to the loading docks of the hospital, and designated pickup schedules with a local trucking company. A Columbus hospital would not have to worry about the sorting of such medical supplies generated, or its intricate route into the hands of a physician in a developing country. Such confined tasks, thus, become manageable and appealing for a Columbus hospital to begin collection of this durable streamline essentially because it involves simple decision-making within the purchasing department, and much of the bulk labor is already defined in a working capacity through OSUMC's Automated Transport System. When tailored into five key

logistical steps, the collection and diversion of reusable medical supplies becomes a manageable and worthwhile project, even for an institution as expansive as Ohio State's University Hospital. The summarized steps for an ideal diversion route for reusable medical supplies are shown below in Figure 8.

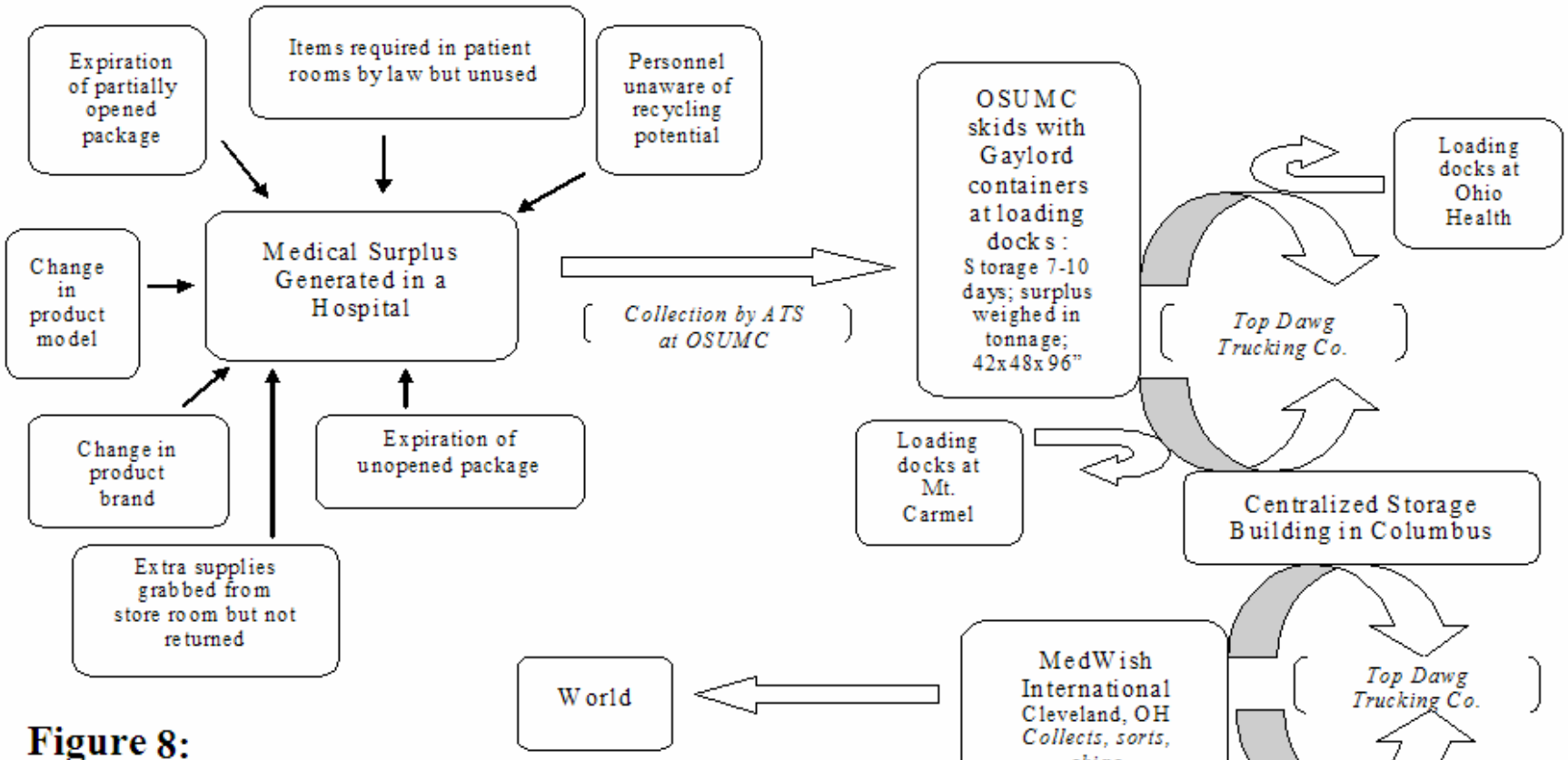


Figure 8:

How Medical Surplus Could be Diverted from Mainstream Waste in an Ideal Route

Chapter 9: The Ethics of "Waste" vs. "Surplus"

Why Medical Surplus is not Waste

Throughout this rerouting and economic analysis of reusable medical supplies generated at OSUMC, it is important to distinguish between two basic terms: "waste" and "surplus". For the purposes of this research project, the durable medical supplies under study must be referred to as "surplus", and not "waste". "Waste", especially in the context of landfill mainstreams, implies a useless material value; time and materials which are wasted, by definition, mean they are lost or inadequate, and neglected in some way. Referring to such bulk medical supplies as "surplus", however, inherently implies their content is still usable, worthy, and purposeful. Moreover, referring to surplus medical supplies as "waste" introduces an ethical question. *If such medical surplus is truly hospital waste, how does a humanitarian effort to orchestrate its international donations remain ethically sound?* The response to this question, concerning the quality of medical product involved, is simply that this international donation *is* humane because the medical surplus items *are* useful, and hospitals in developing nations *are* receiving items they otherwise wouldn't for their normal operations. When referring to durable medical materials as "surplus", it offers an under-supplied hospital the capacity to increase their stock of usable material, and it gives American physicians and hospital professionals incentive to actively contribute to a project that has purpose and worth. This *is* an ethical practice. In addition, medical items donated, while they may be expired or unsterile, are either still usable past expiration, able to be repurposed, or have the capacity to be re-sterilized. Organizations such as MedWish International are responsible for sorting medical supplies donated, removing all stickers and labels that trace a hospital's identity, and assess the supply needs of the

impoverished hospital to avoid sending unusable product overseas. Donating bulk medical items internationally is not harmful to the communities and patients it reaches; so if physicians oath to "do no harm", participating in a collection program must be a part of their routine workday as it is in accordance with this creed. What, in fact, *is* harmful for a developing nation is *knowing* that a medical supplies need *does* exist in their hospitals, and yet disregarding an opportunity to offer them a solution when surplus medical products are sent into landfill space along with the mainstream trash. And the ethics of sustainable healthcare have received worldwide attention.

During a spring, 2008 OSU global health lecture given by Dr. Waldman (Director of the Center for Global Health and Economic Development at the Mailman School of Public Health of Columbia University), insight concerning global humanitarian aide was discussed to improve the conditions of impoverished medical systems. As co-author of the UN's publication of the "The Sphere Project", Dr. Waldman urged a shift in international humanitarian aid as *a basic human right* for people around the world. He argued to view the issue of sustainable healthcare as a fundamental *right,* so that, by definition, some alternative source has an *obligation* to fulfill this basic human need. Effectively, public health and global humanitarian aid can become a responsibility for society as opposed to transient opportunities for charity donations when parts of the world are romanticized in their need for medical attention. Moreover, Dr. Waldman mentioned examples of refugee camps established after the Rwandan genocide that were ineffective in serving thousands of displaced African citizens because the refugees could not physically or psychologically commit themselves to these established medical sites. According to his statistics, nearly 90% of these African refugees died without getting any medical attention. Dr. Waldman's conclusion was that the only way to provide effective humanitarian assistance is to step outside established United Nation refugee camps, and engage the communities of

developing nations. This conclusion essentially encapsulates the success shown by medical teams and their donated surplus like teams offered through MedWish International as the most effective means in improving deficient healthcare systems worldwide.

Terminology, thus, plays an important role in the perception and effectiveness of such a medical recycling program. Hospital staff, humanitarians, and environmentalists involved in this collection and redistribution project must be conscious of the impact in defining re-usable medical product as "surplus" and not "waste". As awareness for this repurposing program increases, our society must understand these international donations are a bonus to the supply pool of third world hospitals, and thus these usable products are humanitarian aid with an ethically justifiable purpose.

Conclusion

Despite the need for long term reform in humanitarian aid, much can be accomplished within hospitals across the United States to improve the current healthcare standards of developing countries around the world. "Resource recovery, not just in the case of municipal solid waste but also with regard to other waste streams, must be implemented in order to keep depletable resources in the economic system rather than dispensing them in away which defies reuse" (21). The truth is that OSUMC has the means to begin a medical surplus diversion program for many reasons. One particular component of this fact is due to OSUMC's multi-million dollar robotic Automated Transporting System which would effectively replace the manual labor in transporting surplus collection bins from the department floors to Environmental Services on the ground floor of University Hospital. In fact, such small-scale medical surplus diversion programs exist at Nationwide Children's Hospital right now. In addition, other

Columbus hospitals and medical facilities nationwide are taking active steps to reduce their ecological footprints. They, thus, demonstrate the opportunity and encourage OSUMC to get involved in a surplus repurposing program, which spans an environmental and humanitarian effort. Through hospital employee training, and area-wide administrative seminars, awareness about organizations such as MedWish International and Remedy could highlight the extensive opportunity Columbus hospitals have for operating in a more environment-conscious manner and for improving healthcare standards throughout the world. The diversion of surplus medical supplies is an issue largely neglected by hospital administrations, yet is gaining awareness through the media publications of mainstream global humanitarian issues. With such a widespread movement to "go green", the current decade presents itself an opportune time to raise awareness about this issue, and has a potential to create momentous international impact for citizens living under impoverished healthcare standards. Imploring a change in worldview perspective for public health services and humanitarian aide has clear potential to improve healthcare in developing nations; more pivotal still, this entire training process begins with calling reusable medical product as "surplus" and not "waste". Citizens of the world must view health standards as fundamental human rights and not mere opportunities to fulfill a moral consciousness. With the collaboration of local hospitals and environment-conscious citizens, increased medical supplies and higher healthcare standards could be achieved on an international level.

Future Plans and Research Products

The momentum of the research process and the completion of this thesis present an opportunity to propel these discussed ideas into action within the subsequent year. I plan to

participate in the 2009 Denman Undergraduate Research Forum at The Ohio State University in May. The research forum involves a poster or multimedia presentation for a panel of faculty members, PhD candidates, and corporate judges, who will assess student research projects spanning a wide range of disciplines and not limited to laboratory research. In addition, cash prizes will be given to winning contestants in each of the final categories. Other immediate goals to advance this thesis include article publications within local newspapers such as *The Columbus Dispatch* and *The Lantern*.

A look at longer-term research projects point to the involvement and coordination of OSUMC administrators and a MedWish International partnership. According to Tish Dahlby, executive director of MedWish International, there is an interest in attaining grant money to establish a MedWish branch in Columbus, Ohio. Grant proposals will be written and submitted throughout spring, 2009, to sources within the Ohio State community, as well as to private donors and corporate businesses. A meeting with OSUMC department directors, including representatives from Environmental, Distribution Services, and procedure areas of University Hospital, will occur in the spring, in which a copy of this thesis will be provided and discussed to assess the benefits of such a repurposing effort. Finally, a follow-up with Mount Carmel Hospital will also further investigate the potential to solidify a surplus storage building for participating hospitals in the Columbus community to donate their generated surplus product. The ultimate future objective for this thesis is to achieve a community involvement for the rerouting of medical surplus, beginning with participation of a few hospital branches and expanding hospital involvement within the greater Columbus area.

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