

UCLA HEALTH SUSTAINABLE WASTE MANAGEMENT

2024 FINAL REPORT

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Abstract

Historically, the healthcare industry has lacked a comprehensive approach to sustainability and waste consciousness. This issue is compounded by the absence of robust measures to promote waste sorting amongst employees and visitors, leading to a significant volume of compostable and recyclable materials ending up in landfills. Research suggests that centralized waste bins – with separate streams for landfill, compost, and recycling – can effectively divert waste and mitigate environmental damage. This report presents a research project conducted by the Sustainability Action Research (SAR) Health Waste Pilot Program Team at the University of California Los Angeles (UCLA). The project aimed to implement a small-scale centralized waste system (CWS) throughout the non-clinical spaces of Ronald Reagan UCLA Medical Center (RRUMC). These non-clinical spaces are not related to, involved, or concerned with the direct observation and/or treatment of living patients. The objective of the CWS was to help achieve UCLA Health’s sustainability goal of diverting 50% of waste from landfills and reducing waste per adjusted patient day to 25 lbs by 2025. The research methods included comprehensive interviews with UCLA Health’s contracted waste haulers and environmental services (EVS) workers, a quantitative audit of various waste streams from nonclinical spaces before and after the implementation of a CWS, and a survey of UCLA Health employees to gauge staff attitudes towards sustainability and the new waste management system. These research avenues found a positive correlation with the CWS and a decrease in landfill waste, along with a productive and encouraging response from EVS and UCLA Health staff. The study concludes that a full, system-wide implementation of a CWS in nonclinical spaces would be effective in reducing landfill waste and is a valuable tool for RRUMC to promote sustainability in the non-clinical health setting.

Introduction

UCLA Health, encompassing four hospitals, faces pressing challenges with its waste management practices. Currently, the lack of compost and recycling infrastructure results in a majority of waste being directed to landfills, which damages surrounding ecosystems. Working alongside Noah Bidna, Sustainability Analyst for UCLA Health, the Health Waste Pilot Program team aims to transform these practices by introducing the CWS. The CWS is defined as a three-stream waste bin (landfill, recycling, compost) placed in a central location within the office spaces and break rooms under observation. The central goal of this project was to gauge the impact of a small-scale implementation of the CWS on landfill diversion within UCLA Health's non-clinical spaces. The research team sought to answer two fundamental research questions: what is the impact of implementing a CWS on diverting non-medical waste (in pounds) in non-clinical hospital office settings? What is the impact of UCLA Health's CWS on marginalized communities exposed to waste management facilities?

Effective waste diversion holds the potential to curtail the amount of recyclable and compostable material ending up in landfill bins, thereby reducing greenhouse gas emissions, the need for raw material extraction and manufacturing, and contributions to water and soil pollution. As highlighted in the initial literature review, healthcare waste (HCW) encompasses both hazardous and non-hazardous components, where non-hazardous waste constitutes approximately 80% of the total HCW stream, as estimated by the World Health Organization (Smith et al., 2015). Not only does this contribute to the global waste problem, but to several other environmental issues. For example, the healthcare industry contributes to 8% of the United States' total annual carbon dioxide emissions (Thakur & Ramesh, 2015; Johnson et al., 2017). Recognizing these statistics, the research team aims to divert landfill waste by updating hospital

infrastructure, using data collected before and after implementing the CWS to identify the amount of waste in each stream. Previous efforts to limit hospital-generated waste, such as those at the University of Michigan Health, have shown success in reducing solid waste and diverting incinerated waste by employing recycling and segregating waste streams (Vittori & Guenther, 2008). Their effort, which led to reducing medical waste incinerators from 6,200 to fewer than one hundred, indicates the potential efficacy of sustainability improvements via segregated waste, medical or otherwise.

Given this, the research team hypothesizes that the implementation of the CWS will yield a statistically significant increase in waste diversion from landfills towards recycling and composting facilities. This stands in contrast with the current system, characterized by the predominance of landfill bins placed throughout the medical centers (refer to appendix A). While the team stakeholder recalled one centralized waste bin at RRUMC within the sixth floor break room, it was nonfunctional, capturing compost, recycling, and landfill waste together – negating the intended separation of waste streams (refer to appendix A). This project is centered around the Ronald Reagan and Santa Monica Medical Centers, both of which are branches of UCLA Health. Pre-implementation audits conducted at these sites set the stage for the CWS, as detailed in the subsequent sections. Within these hospitals, the research team implemented centralized waste bins across seven different non-clinical office and lounge units. The pivotal variable under examination is the bins themselves, each equipped with separate compost, recycling, and landfill streams for non-hazardous waste. A successful outcome at this pilot scale holds the promise of expansion across Ronald Reagan and Santa Monica Medical Centers, as well as adoption by the remaining two UCLA Health hospitals.

Methods

Waste Audits:

Before implementation of the CWS, it was essential to conduct a comprehensive baseline assessment of the current waste management practices and quantify the amount of non clinical landfill waste being produced by UCLA Health. This included an audit at Santa Monica UCLA Medical Center (SMUMC) on Friday, January 19th 2024 and at Ronald Reagan UCLA Medical Center (RRUMC) on Thursday, February 22nd 2024. The auditing process started with receiving waste from landfill bins from various units in the hospital. At SMUMC, waste came from the dining commons, intensive care unit (ICU), and A-level, while at RRUMC, waste was obtained from patient care units on the 3rd, 5th, and 8th floors of the hospital. After obtaining the waste, it was weighed to quantify the amount of waste that would have been directed to the landfill. The waste was then correctly sorted and weighed in the three streams: compost, recycling, and landfill. The sorting and weighing of individual streams provided data on the quantities of recycling and compost that hypothetically will be diverted from the landfill through implementation of the CWS. The data obtained from the pre-implementation audits was used as a proxy for the actual units in which the CWS was implemented.

On Thursday, May 23rd 2024, a second audit was conducted at RRUMC, following the implementation of a CWS in 7 different municipalities in the hospital. This audit followed pre-implementation audit methodologies, except that the sources of waste in each differed. In the post-implementation audit, waste was gathered from seven non-clinical units, including care coordination, respiratory therapy, pathology & laboratory, volunteer services, and clinical engineering. The amount of waste in each stream before and after sorting by the research team was weighed to determine the amount of improperly placed waste by the users. Statistical

analysis was then used to determine the efficacy of a CWS in diverting waste towards composting and recycling streams. Despite completing a pre implementation audit at SMUMC, a CWS was unable to be implemented due to bin quantity and time limitations. Further, CWS bin implementation and subsequent methodologies were carried out exclusively at RRUMC.

Behavioral Survey:

Following the implementation of the CWS on Thursday, May 9th 2024, a behavioral survey was distributed on Tuesday, May 21st 2024 to RRUMC Health staff in the units of interest. The survey purpose was to analyze the behavioral aspects associated with adopting a CWS. The survey focused on two facets of waste consciousness: the employees' perspectives on workplace sustainability and how the introduction of the CWS has influenced these viewpoints. Survey responses guided the assessment of difficulties individuals encountered while utilizing the CWS. This component provided an alternative perspective to evaluate the practicality of the CWS, offering insights to adapt aspects of the system based on feedback given by end-users.

EDI Impact Research:

Interviews with various levels of waste management were conducted to evaluate the equity, diversity, and inclusion (EDI) of the CWS. The first set of interviews conducted included hospital and EVS staff that utilized the newly implemented CWS. While non-EVS staff could have had access to the centralized waste bins in passing, the interviews focused on staff who continually interacted with the CWS. These interviews addressed the movement of waste after leaving the CWS bins and identified problems with CWS utilization post-consumer.

Additional interviews focused on RRUMC waste hauler's end-of-the-line waste management and sustainability practices. Jennifer Duet, a Sales Strategy Manager for Athens Services, was chosen as the interviewee due to Athens' relationship with UCLA Health as their

contracted waste hauler. Duet's interview was conducted to gain knowledge into the impact of Athens waste management facilities on surrounding communities and addressed EDI-related challenges when processing waste at composting and recycling management facilities. Questions asked in all interviews assisted in identifying how waste management practices related to the CWS will impact minority groups and highlight ways that could mitigate negative effects.

Challenges

Several challenges were encountered over the course of the project. First, the CWS bins that were intended to be used for implementation were on backorder, meaning they would not arrive with sufficient time to collect data before final deadlines. This was quickly resolved with the help of the SAR Program Directors and the Deputy Chief Sustainability Officer, Bonny Bentzin. Nine bins were borrowed from the campus sustainability department which were promptly implemented throughout RRUMC on Thursday, May 9th 2024.

Secondly, communication in regards to the implementation of the bins to all relevant staff posed a challenge. Since the custodians were not informed of the implementation, they were not properly trained on upkeeping the CWS. It was also difficult to communicate expectations of proper waste sorting and the importance of the CWS on sustainability to relevant staff.

Additionally, issues arose relating to the accuracy of scales used to weigh the waste during both pre-implementation & post-implementation audits. These inaccuracies resulted in minor discrepancies in the total weight of waste before and after re-sorting, despite the waste volume remaining the same. Consequently, the numbers used in the data analysis were approximations. While not ideal, the broader objective of the project allowed for some small errors in weight measurements, as general trends in data would theoretically still hold true.

Finally, the limited amount of post-audit data and the relatively low number of hospital staff survey participants, totalling eighteen responses, posed challenges with reliability of findings. The unexpectedly low participation in the survey made it harder to gauge attitudes toward the CWS of the whole population of interest. In regards to interview data, it was difficult to gather a wide range of perspectives of people involved in the waste stream process. The initial goal was to gain a more in depth understanding of the role of Athens Services in the waste stream, especially since they were responsible for the waste processing after it leaves UCLA. The research team intended to but could not interview waste hauler drivers, facilities managers, and employees directly handling the waste. The lack of these insights posed a challenge in understanding the effects of a CWS on waste management employees and other impacted communities. Nonetheless, the available data suggested that the new CWS implementation was somewhat effective and that hospital staff had positive experiences utilizing the bins.

Results

Audit Data:

To begin, a pre-implementation audit was conducted in the UCLA Health institutes. The result from the pre-implementation reveals that all waste was originally directed into one landfill bin to be handled next by the waste hauler. This manual waste audit conducted by the research team showed that a significant amount of waste, roughly 25% of the sample, should have been grouped into the compost and the recycling categories.

After the implementation of the CWS, a sequential waste audit was conducted. This audit revealed that hospital employees were starting to properly sort the waste into different categories and that the implementation was effective in diverting waste from landfill. This

post-implementation data was then analyzed by the research team who sorted through the three streams once more for any improperly placed waste. This secondary sorting found that even more waste put into the landfill bins could have been composted or recycled. For example, many napkins were found in all three streams when, ideally, they should all be composted. This final audit data illuminated the fact that while the bins reduce landfill waste, there is certainly room for improvement with regards to user education on proper disposal and waste sorting practices.

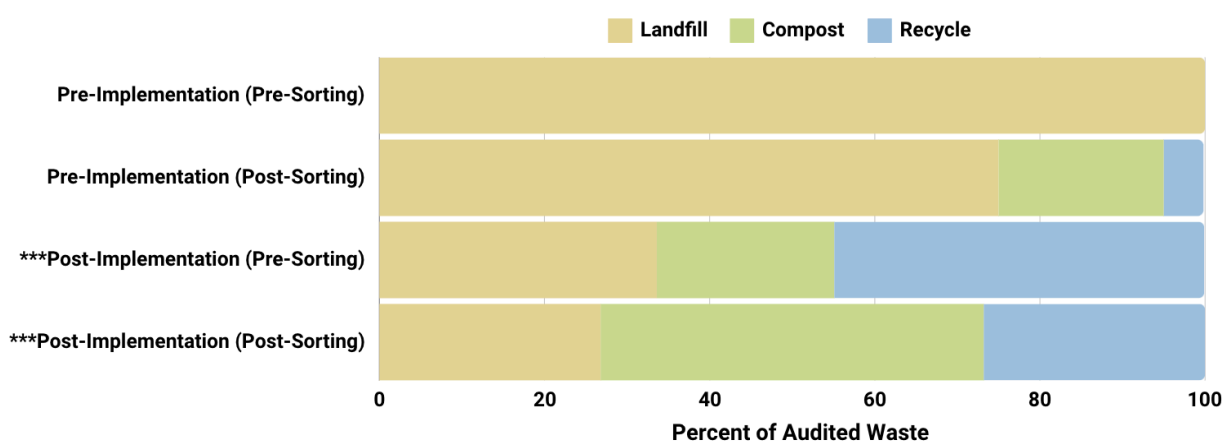


Figure 1: horizontal stacked chart of the CWS raw audit data

A line graph is also used to visualize the data more clearly. In figure 2, the x-axis is the implementation timeline while the y-axis is the percentage of the trash in each of the three streams (landfill, compost, and recycling). From examining the graph, it is clear that there is a decreasing trend for the landfill trash as noted by the dotted, tan trend line in the graph below. There are increasing trends for the compost and recycling waste as well, corroborating the landfill's downward trend. To evaluate the pattern of the landfill data points and its linearity, an R value is calculated. This R value is roughly -0.97, which suggests the model has a strong, negative linear correlation. This result further helps to clarify the relationships between the CWS implementation and the trash diverging results. In addition, a p-value, which indicates a level of confidence in the data, was calculated based on the model null hypothesis that the coefficients in

the model are not significant. The yielded p-value of 0.0295 essentially means 2.95% of the data is estimated to be accidental, which is a significant result based off of a 95% confidence test. This small p-value rejects the null hypothesis and concludes that the data trends reasonably reflect the true population features. In conclusion, the trends and the statistical testing results suggest that the CWS is effective in diverting landfill waste at the RRUMC.

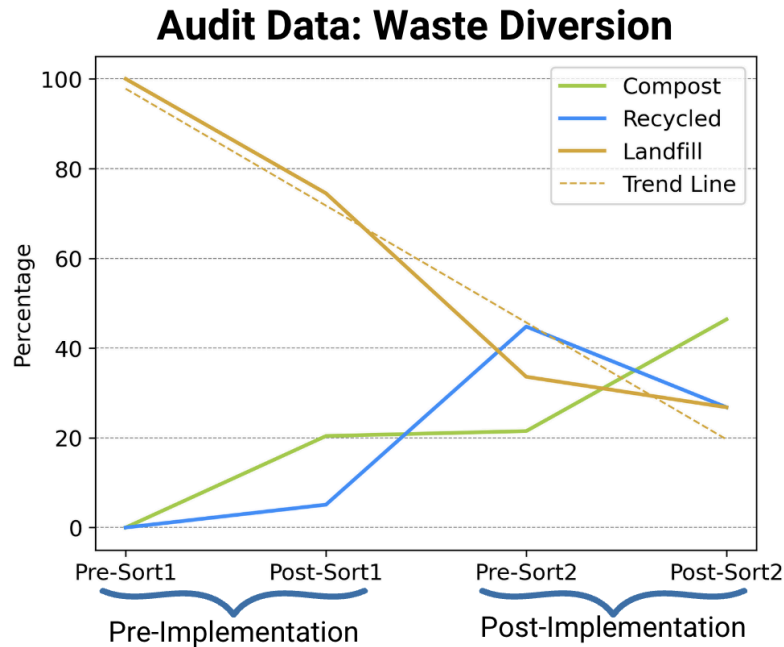


Figure 2: line chart of the audit data

Behavioral Survey Data:

To further contextualize the audit data and gauge response to the CWS, eighteen employees that used the CWS for 3 weeks within the 7 units of the study were surveyed. From the eighteen responses, it was gathered that while most users found the new CWS bins to be beneficial, there is a need for larger bins and more education on how to properly utilize them.

These survey responses offered the opportunity to analyze RRUMC employees waste disposal practices before the implementation of a centralized waste system to get a baseline understanding of their concern for sustainability; the results are shown in the pie chart below

where more than half of the respondents disposed of waste appropriately only some of the time prior to the new bins, as most individuals wouldn't go out of their way to find a separate recycling bin to dispose of recyclable waste.

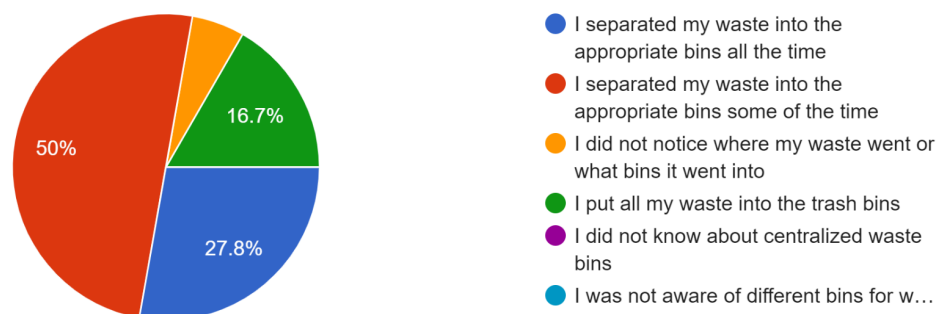


Figure 3: pie chart of waste disposal behaviors prior to CWS

The lack of compost bins prior to the implementation of the CWS was reflected in the survey participant's unfamiliarity with waste categorization, providing feedback such as "The bins, though apparently well-intentioned, lead to much confusion [...] about where to dispose of specific items. Please either clarify things or remove the confusing bins." Such survey feedback can be used to inform future implementation of a CWS, emphasizing the need for further education beyond simple graphics and signage above the centralized waste bins.

After examining hospital staff's waste disposal behaviors prior to the CWS implementation, the survey was used to measure the impact of the CWS on their disposal practices and level of concern for sustainability. Of the respondents, 66.6% said they were more aware of the significance of waste diversion after using the new bins, indicating a fundamental change in habits and consciousness of sustainability when having to pause and sort their waste at the bin.

To then identify how receptive UCLA Health employees would be for a larger scale implementation of this system, the research team asked a variety of questions related to CWS bin effectivity and convenience. 66.7% of respondents said that they experienced no challenges or barriers when using the CWS, even presenting positive feedback such as “Since the centralized waste bins have been implemented it’s more convenient to sort our trash”. Of the 33.3% of respondents that noted that they did experience challenges with using the bins, more than half of them had mentioned the current CWS overfilling too quickly due to its small size.

Therefore, the main takeaways from this survey would be that education, better signage, and larger bins are factors to keep in mind to ensure a successful large-scale integration of the CWS within UCLA Health. From the end-user perspective, positive survey feedback and change in sustainability consciousness indicate that a large-scale roll-out would ultimately be welcomed and beneficial.

Interview Data:

As previously mentioned, interviews were conducted to gain an understanding of how implementing a centralized waste system could affect the productivity of the waste stream and the equity, diversity, and inclusion of staff and communities surrounding waste management facilities. Following the flow of the waste stream, the research team first interviewed members of the custodial staff within the EVS department. With the implementation of the CWS, their role evolved to include placing the correctly colored trash bag in each stream and collecting the filled trash bags separately. When interviewing Milargo Ramirez, the Custodian Supervisor of EVS, and Doris Eduarte, Management service officer, they expressed how the centralized waste bins might be better for custodial employee’s health. Rather than bending down for small trash cans under each desk, staff are able to collect all three streams of waste at one centralized location.

Consequently, this design causes less physical strain and repetitive motion injuries, making the workplace more inclusive and accessible for custodians.

However, Ramirez and Eduarte also stated that there are significant challenges with waste disposal when custodial staff are transporting the waste to the loading dock. After collecting waste from the CWS, staff transport waste to the loading dock, where there are three respective compactors for landfill, recycling, and compost. Ramirez and Eduarte indicated that there is limited disposal of the respective streams into separate bins within the loading dock even if individuals effectively sort their trash into the CWS bins. The loading dock is also the final destination of the trash before it gets collected by waste hauler companies. Here, the research team interviewed Brian Tucker, PD service partner. Tucker stated that when the different colored trash bags are not clearly and correctly separated within the waste transportation carts, all waste contents may simply be thrown in the landfill dumpster. It is tedious and inefficient for custodians to dig through mounds of trash bags and organize them if they are not already separated conveniently. For future research on streamlining the waste stream, he suggested that the utility cart custodians use to collect trash should have a built-in solid divider.

Finally, the waste gets collected by a waste hauler company. Ronald Reagan medical center utilizes Athens Services. In speaking with Jennifer Duet, an Athen's Services sales manager, the research team learned that Athens Services is a waste management company that focuses on the "recovery" of waste. Although they play an important role in the recovery process of centralized waste, their knowledge and initiatives on sustainability is limited. The company is limited to a more passive role in changing waste streams as most of the power lies in customer and company initiative choice. Duet also had limited knowledge on how Athens facilities and transportation routes might affect nearby communities, which affects our understanding of how

CWS accounts for the diversity, inclusion, and equity of affected communities. She also explained that compostables must break down in 60 days or less or they will be sent to the landfill. This limits waste diversion to primarily organics rather than bioplastics or more durable "compostables." This information exposes a systematic issue in the waste stream process and another barrier towards sustainable waste. Even if the Centralized Waste System is able to divert waste from landfill, many companies might not have the facilities to process the compostable waste. In the end, efforts to create more sustainable products and diverting trash from landfills must be met with systematic changes in waste processing beyond simply implementing CWS bins.

Discussion

From the results of this project, one can conclude that the Centralized Waste System does indeed confirm the hypothesis that it diverts waste from the landfill. However, waste isn't always sorted properly, perhaps due to a lack of education or concern that must be addressed at a systematic level in order to make significant change.

Before making recommendations, the research team would like to acknowledge some project limitations. Only one pre-implementation audit and one post-implementation audit was conducted during the research process due to time restraints and coordination issues with hospital management. The team only had a total of 12 data points (6 for pre-implementation audit and 6 for post-implementation audit) and two time points to compare the results with. The statistical model is built based on limited data. Therefore, the model may not be the most accurate representation of the situation at the RRUMC. Future audit data should be collected for the purpose of portraying a more precise visualization of the effect of the CWS implementation.

Additionally, the survey only received eighteen responses. With more survey respondents, the research team would be able to gauge a more accurate consensus from the staff's opinions on the implementation.

In the future, the research team would recommend implementing the centralized waste system throughout the entire UCLA Health system, which would encourage progress towards UCLA Health's sustainability goals. However, to address the issue of a lack of education & concern, the research team would recommend providing education—such as through brochures or a mandatory online training course—for all UCLA Health employees. This education program could focus primarily on how to sort waste and emphasize why it is an important practice in healthcare facilities. This would ideally improve the accuracy of waste sorting and enforce its importance to the environment. Additionally, implementing the three-stream waste bins in early education facilities is highly recommended. In this case, sorting waste becomes a habit for young children which they can carry into adulthood.

Moving forward, future SAR teams may find ways to streamline the collection process for custodians, as the human power required to separate waste into the three streams was discovered to be a huge limitation of the CWS. Could the height of the bins be adjusted for easier waste collection? Is there a way for the CWS to be mirrored in the waste collection bins used by custodial services for easier disposal? Additionally, future SAR students may investigate different phases of the waste management process beyond the scope of this project. This could include more in-depth research on managing compost and the associated infrastructure within waste management facilities.

Overall, the research team looks forward to seeing both the successes and limitations of this project utilized to inspire future SAR research within UCLA Health. With annual action

from SAR, there is great potential for UCLA Health to reduce landfill waste, mitigate environmental damage, and protect communities in contact with the waste management process.

Appendix

Appendix - Visuals of Current Waste Bins

Floor 6 Hallway Landfill



Floor 3 Hallway Landfill



Floor 6 Breakroom



**Note:*

Floor 6 Breakroom's "Centralized Waste Bin" doesn't have separated bags (non-functional)

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