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Evaluating Driveway Cross Slopes and Social Equity in Cedar City, UT

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ABSTRACT
The Americans with Disabilities Act (ADA) is the most comprehensive law governing accessibility, and it requires local governments to develop transition plans to become compliant. Among the key ADA requirements is a continuous unobstructed pedestrian circulation network that consists of a sidewalk that has a cross slope of no more than two degrees. The primary objective of this research was to evaluate whether driveway cross slopes in Cedar City were ADA compliant, so a digital level was used to measure a random sample of driveway cross slopes. A secondary objective was to determine whether there is evidence of social inequities in Cedar City's pedestrian environment. The estimated value of each residential property (a proxy for income) was retrieved from Zillow® to evaluate the statistical relationship between incomes and driveway cross slopes. The results of this study indicate that there was no widespread evidence of social inequities. However, most driveway cross slopes (78.8 percent) were not ADA compliant and, thus, require retrofitting that should incorporate more widespread use of sidewalk buffer strips. The results also highlight priority areas for sidewalk improvements and can be used to inform a transition plan for sidewalk enhancements and funding.

KEYWORDS
Social Equity; ADA; Sidewalks; Advocacy Planning; Driveway Cross Slope; Walkability

INTRODUCTION
The design of our built environments has implications for accessibility (i.e., connecting people across a community network) and mobility (e.g., physical mobility and automobility), especially for those people who are living with physical mobility limitations or lack transportation options. Beyond the potential for our built environment to exclude people living with a physical disability, it is important that our communities are designed to be accessible and inclusive for everyone.[1, 2] Accessible built environments enable people of all ages and mobility levels to engage in the out-of-home activities that are required to meet their daily needs for services and social contact.[3] Engagement in out-of-home activities is an important aspect of daily living,[4] and is a key indicator of healthy aging[5] and quality of life.[, 6, 7, 8] Unfortunately, however, the design of far too many communities inherently imposes accessibility barriers (in both space and time) that hinder one's mobility, thereby preventing people from meeting their daily needs. Mobility can be hindered by physical mobility barriers, especially for those who are living with a physical disability, and by transport mobility barriers for those who lack reliable access to a car (i.e., automobility) or reliable public transit. Therefore, those people with mobility constraints and/or those who are especially tied to locality, such as children and older adults, are particularly vulnerable to these accessibility barriers.[9] Thus, the form and function of our communities have the potential to cause social inequities, which lead to a sense of isolation and exclusion, and in turn downgrade citizens' sense of independence, quality of life, and health.

Accessible built environments are expected to become increasingly important over the coming decades in the United States of America (USA) due to the increasing prevalence of adults living with a disability. More specifically, the number of adults ages 65 and older in the USA is expected to more than double over the next 40 years.[10] This so-called "gray tsunami"[11] will inevitably have serious implications for our society, our economy, and our communities.[12, 13] Moreover, the nationally representative panel Survey of Income and Program Participation (SIPP) indicates that 27 percent of adults aged 18 and older are living with a disability.[14] Notably, however, estimates from the SIPP exclude adults living in assisted living facilities, where 97 percent of adults aged 65 and older are living with a disability.[14] Because population aging is a global phenomenon,[15, 16] the World Health Organization[17]developed an "age-friendly cities" framework to promote the design of inclusive, healthy, and accessible urban environments that support active and healthy aging.

A continuous, unobstructed, accessible pedestrian network is an important component of an inclusive and age-friendly community for at least two reasons. Firstly, a community derives numerous social, economic, and environmental benefits from having an accessible pedestrian network.[18, 19, 20] Secondly, a community has a legal requirement to consider the needs of individuals who are living with a disability when designing the built environment.[21, 22, 23] This legal requirement began as narrow architectural standards, but it has evolved into the Americans with Disabilities Act (ADA), which guaranteed equal access to people living with disabilities and required local governments to develop transition plans to become compliant with the provisions of the Act.[24] The transition plan requires a self-evaluation to identify accessibility barriers and provide an opportunity to evaluate a community's compliance with accessible design guidelines. One of the primary goals of evaluating the pedestrian environment in Cedar City was to provide an initial assessment of compliance with ADA standards. An 'assessment of compliance' is the first step in the self-evaluation process required for an ADA transition plan. The significance of this process is to ensure that public services (i.e., businesses, employment, services) along a public street are accessible to people living with a disability.

Among the key requirements of the ADA is a continuous unobstructed pedestrian circulation network that is comprised of a sidewalk that has a cross slope of no more than two degrees (i.e., 3.5 percent). As quoted in another source,[25] the Access Board[24] states that "excessive cross slope is the single greatest barrier to travel along sidewalks and shared-use paths for pedestrians who use wheelchairs and scooters, pedestrians who use walkers and crutches, pedestrians who have braces or lower-limb prostheses, and those with gait, balance, and stamina impairments". In addition to concerns about wheelchairs tipping over or people falling is the associated concern that such a loss of balance typically results in the person falling toward the vehicular traffic in the street. An added concern is that children living with a disability may be less able to compensate for cross slope than adults.[24, 25] Unfortunately, however, there is a dearth of research into the impact of cross slope on sidewalk accessibility for people living with disabilities,[26, 27] despite the call for such research dating back more than four decades.[28]

This research is grounded within the disciplinary framework of advocacy planning,[29, 30] which focuses on providing a 'voice' for the unmet mobility needs of both older and younger citizens, especially those living with a disability. Also, the current public health and climate crises urgently require the promotion of active transportation.[31, 32] Consequently, the results of this study have implications for social equity, age-friendly community design, plus economic, environmental, and public health. The primary objective of this research was to evaluate whether a random sample of Cedar City's driveway cross slopes was compliant with ADA standards, which means less than or equal to two degrees. A driveway cross slope is defined as the angle of the sidewalk perpendicular to the direction of pedestrian movement where driveways cross the sidewalk, and it is usually measured at the middle of the driveway. A secondary objective of this research was to determine whether there is evidence of social inequities in Cedar City's pedestrian environment. The results of this study highlight priority areas for sidewalk improvements and can be used to inform a transition plan for sidewalk enhancements and funding.
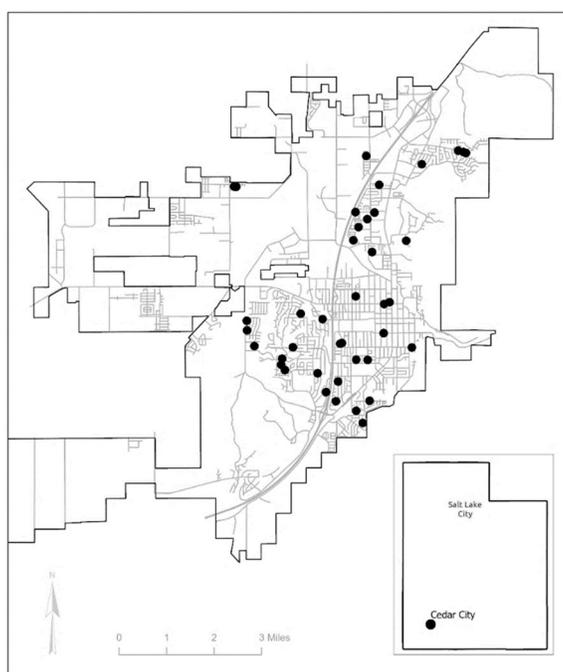

Figure 1. Map of randomly sampled 60 road segments within Cedar City, Utah.

METHODS AND PROCEDURES
The study area for this research was Cedar City, Utah (see **Figure 1**). Cedar City is a micropolitan area located in the southwest portion of the state with a population of 35,235.[33] Both the municipal boundary and statewide roads data were downloaded from the Utah Geospatial Resource Center. The municipal boundary was used to select all road segments that exist within Cedar City limits. Then, IBM® SPSS® was used to select a random sample of 70 road segments from the population of roads within Cedar City. Each of these randomly sampled road segments was evaluated to ensure the presence of both sidewalks and driveways, which disqualified some road segments that were mostly located in undeveloped and industrial areas. The final set of 60 road segments that had both sidewalks and driveways included a total of 369 driveway cross slopes. The angle of each of these driveway cross slopes was measured by the lead author at the middle of each driveway using an M-D SmartTool™ ADA Digital Slope Walker, which is a digital level to measure slopes within one-tenth of a degree (see www.mdbuildingproducts.com). To enable spatial analysis and mapping, the location of each driveway cross slope was recorded by the lead author using ESRI's ArcGIS Field Maps, which is an app that allows real-time collection and editing of location data (see www.esri.com).

In addition to measuring the driveway cross slopes, the estimated value of each residential property (a proxy for income), was retrieved from Zillow®. The estimated values for residential properties were merged with the driveway cross slope measurements, which enabled correlation analysis of the statistical relationship between the two measures. The statistical relationship between estimated values and driveway cross slope was used to evaluate the hypothesis that social equity issues exist in Cedar City's pedestrian infrastructure.

RESULTS
The slope angles were recorded, in degrees, for 369 driveway cross slopes in Cedar City, UT. The statistical distribution of the 369 driveway cross slopes is illustrated in **Figure 2**. Summary statistics indicate that the driveway cross slopes range from a minimum of 0.1 degrees to a maximum of 14.4 degrees with a mean of 4.6 degrees (SD = 2.5). The results illustrated in **Figure 2** indicate that only 21.2 percent of the randomly sampled driveway cross slopes are ADA compliant (i.e., no more than two degrees) while more than 60 percent of the driveway cross slopes exceed 4 degrees.
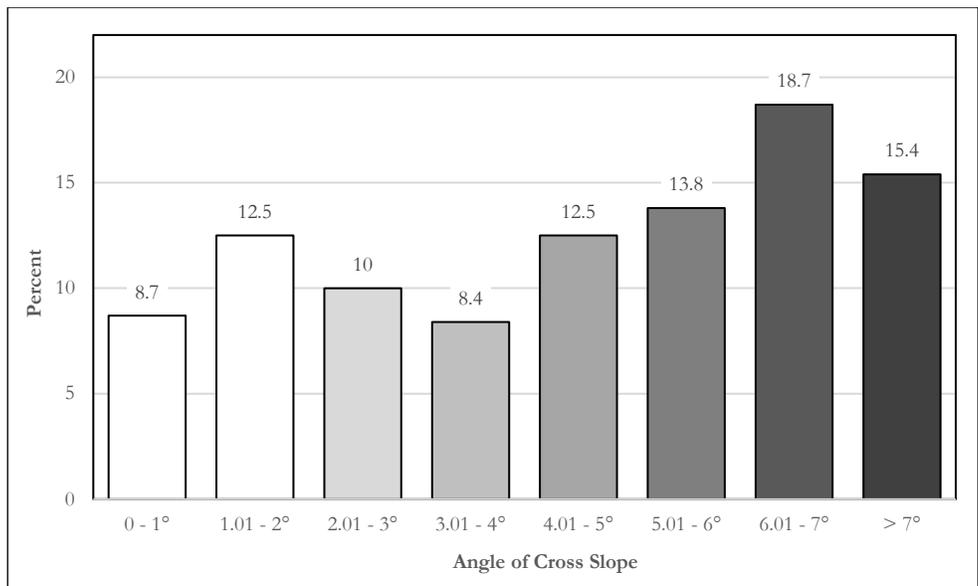
Figure 2. Frequency distribution of driveway cross slopes.

For mapping purposes, the mean driveway cross slope was calculated for each of the 60 randomly sampled road segments. Each road segment had between 5 and 31 driveway cross slopes, with a mean of 9.3 and, due to the positively skewed distribution, more appropriately, a median of 7 driveway cross slopes per road segment. The spatial distribution of mean driveway cross slopes by road segment is illustrated in **Figure 3**. The inset map illustrates the individual driveway cross slopes along a road segment. While this aggregation process of computing a mean driveway cross slope for each road segment obscures the spatial pattern of the full sample, the inset illustrates the need for aggregation for visualization purposes.

Only four road segments have a mean driveway cross slope that conforms to ADA requirements. The spatial distribution of mean driveway cross slopes by road segment suggests the presence of a clustered spatial pattern of high mean values in the north and

south, while lower mean values tend to be located in the central part of the city. To confirm the presence of a spatial pattern among the full sample of 369 observations, the Getis-Ord General G tool in ESRI's ArcGIS Pro (v. 2.8.3) was used to test the null hypothesis that mean driveway cross slope values for road segments are randomly distributed. The results indicate significant clustering driveway cross slope values (z-score = 13.4, p = 0.00) within the study area.
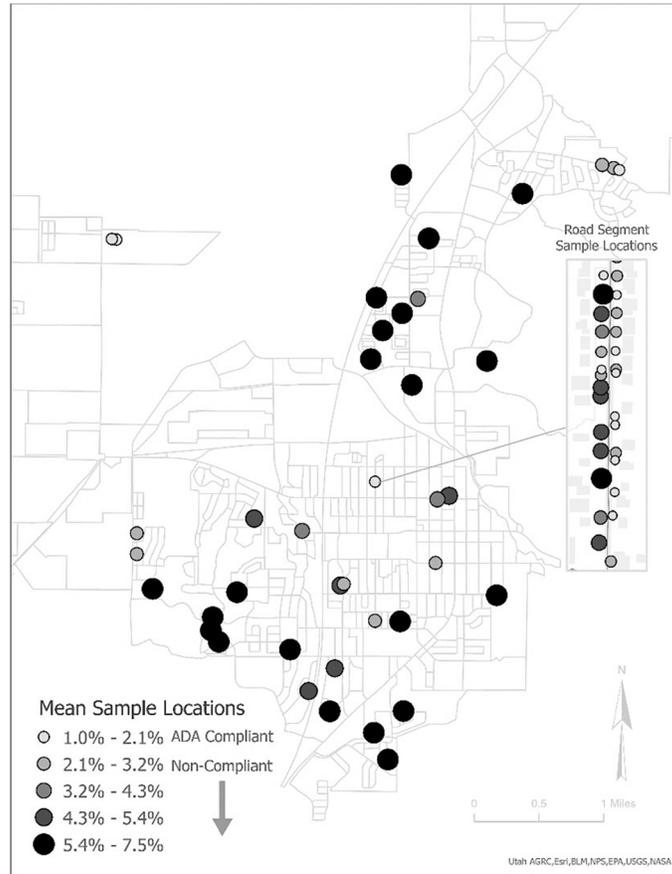
Figure 3. Spatial distribution of mean driveway cross slopes by road segment.

Of the 369 driveway cross slopes measured in this study, the estimated value was retrieved from Zillow® for 279 residential properties only, which excludes industrial and commercial properties. Notably, residential properties represent more than three-quarters of the randomly sampled driveway cross slopes in this study. The minimum assessed value of the residential properties was $158,000 and the maximum value was $948,000 with a mean of $402,681 (SD = $130,599).
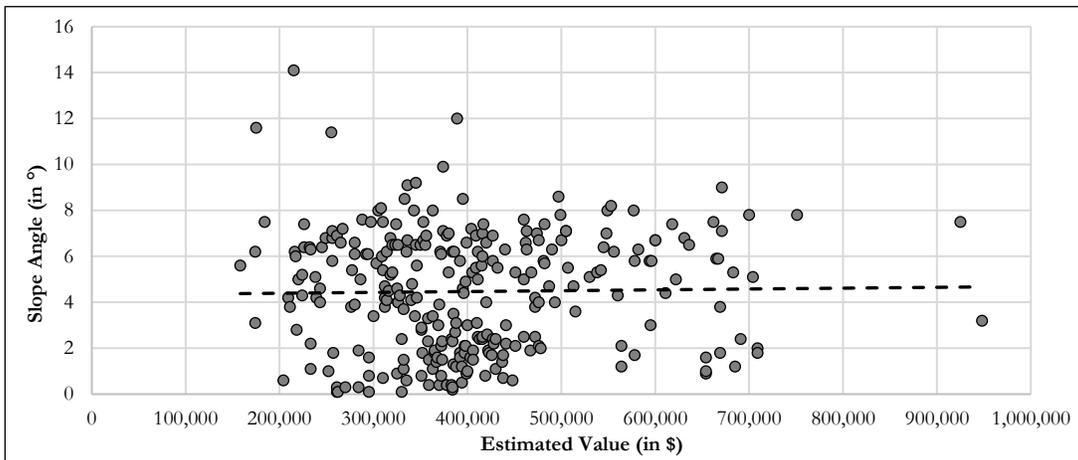
Figure 4. Scattergram of estimated value against driveway cross slopes (n = 279).

Pearson correlation was performed to evaluate the statistical relationship between estimated value (i.e., a proxy for income) and driveway cross slopes. The results of this correlation analysis are illustrated in **Figure 4,** and the results indicate a weak association ($r = 0.019$, $p = 0.378$) between estimated value and driveway cross slope, and that association is statistically insignificant (two-tailed). However, the results in **Figure 4** appear to indicate that the highest slope angles appear to be associated with lower assessed values. To test this apparent association, driveway cross slopes in excess of 7 degrees ($n = 279$) were selected and then Pearson correlation analysis was performed. The results confirm a significant (two-tailed) statistical association ($r = -0.306$, $p = 0.048$) between the highest driveway cross slopes (i.e., > 7°) and estimated value of residential properties.

DISCUSSION

The primary objective of this study was to measure a random sample of driveway cross slopes in Cedar City that would enable an objective evaluation of whether the sidewalk infrastructure, namely driveway cross slopes, were compliant with ADA standards. The results clearly indicate significant ADA non-compliance issues that are widespread throughout the study area, which has the potential to contribute to unmet mobility. The pervasiveness of non-compliance issues associated with driveway cross slopes is evidenced by the fact that 78.8 percent of the randomly sampled driveway cross slopes exceeded the two-degree standard established by the ADA. The results of this research highlight the extent of the problem associated with excessive driveway cross slopes, which represents one of the key barriers to accessibility and mobility,[25] especially for those people who are living with physical mobility limitations or lack transportation options (e.g., older and younger people).

Much of the problem of driveway cross slopes appears to stem from the sidewalk design, which in Cedar City has most sidewalks built at the edge of the street. This design necessitates a steep slope between the street and the driveway, which is therefore directly across the sidewalk. An alternative sidewalk design, which was used extensively throughout the historic district of Cedar City, uses sidewalk buffers (i.e., setbacks, planting strips, or park strips) that allow the sidewalk to be separated from the curb. This separation between the street and the sidewalk, often by two to three feet, enables the driveway cross slope to level off by the time the driveway meets the sidewalk. These sidewalk buffers can provide a host of other benefits to pedestrians and the environment. For example, the increased space between pedestrians and motor vehicles provides increased safety for pedestrians,[34, 35] especially if the buffer areas include large trees. Sidewalk buffers also provide space for planting street trees, which can improve microclimate conditions (e.g., shade) along sidewalks that has been recognized as a major deterrent to walking.[36] Given the excessively wide streets throughout the study area specifically, and in Utah generally, there is more than enough space to build buffer strips that are wide enough to easily accommodate street trees. The argument for the construction of ADA-compliant sidewalks and sidewalk buffer strips becomes even more important within the context of the potential costs associated with ADA lawsuits and forced compliance. Furthermore, the benefits of effective sidewalk design extend well beyond ADA compliance to improve mobility options for the entire community. Notably, several other microscale sidewalk design elements were not included in this study, such as sidewalk quality, street lighting, intersection crossings, and others.[35, 37, 38, 39]

Granted, driveway cross slopes are only one aspect of sidewalk infrastructure, and more information is needed to identify sidewalk gaps, missing curb ramps, running slopes, and other priority areas for sidewalk network improvements. Based on observational evidence over the past few years, it appears that Cedar City has prioritized curb ramps as the largest accessibility barrier and has been actively implementing accessibility improvements over the past decade. However, now that most curb ramps have been improved, it appears that excessive driveway cross slopes may pose the most significant accessibility barrier along Cedar City's pedestrian network. For example, the co-author has slipped and fallen on the 12-degree driveway cross slope on their property when fetching the mail and opts to use the road when jogging. Also, the authors have observed numerous citizens, including young and able-bodied people, opting to use the road in lieu of the sidewalk. These citizens include the public schools' and university's running teams, who mostly choose to run on the road instead of the sidewalk. Presumably, these behaviors are due to excessive driveway cross slope and will be part of our further inquiry into this issue. More specifically, plans for future research involve a series of interviews and focus groups to gain a better understanding of the impacts of driveway cross slopes on pedestrian behaviors.

A secondary objective of this study was to evaluate whether there is evidence of social inequities in Cedar City's pedestrian environment that are associated with ADA non-compliant driveway cross slopes. The results indicate a weak and insignificant association between the estimated value and driveway cross slope, which support the null hypothesis of no relationship. However, the results did find a moderate and statistically significant difference among those driveways with the highest slope angles and lower assessed values. Overall, this research suggests that there may be evidence of social inequities within the historical part of the study area, but those inequities are masked by the high driveway cross slopes for many of the newer, peripheral high-value residential properties. Perhaps there is a need to control for age of the residential properties, and perhaps race, to better understand the spatial distribution of social inequities in pedestrian infrastructure. This assertion is supported by the recent findings that issues associated with "sidewalk quality were significantly associated with older homes, poverty, and race of the block group".[35]

CONCLUSIONS

Driveway cross slopes in Cedar City pose a significant barrier to active transportation, especially for those people who are living with physical mobility limitations. While there does not appear to be evidence of widespread social inequities in the sidewalk infrastructure pertaining to income, the pervasiveness of excessive driveway cross slopes raises serious concerns about the quality of the pedestrian network throughout the study area. This research illuminates the severity and extent of non-compliance with ADA standards and raises further questions about other macro- and microscale sidewalk design elements throughout the study area. This research can also be used to help inform a transition plan for much-needed sidewalk maintenance, enhancements, and funding to improve mobility options and promote an age-friendly community design.

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PRESS SUMMARY

This research used a digital level to measure a random sample of driveway cross slopes in Cedar City, UT, to evaluate whether they were compliant with the Americans with Disabilities Act, which means the slope should not exceed two degrees. This research also collected the estimated value of each residential property (a proxy for income) from Zillow® to evaluate whether there was evidence of social inequities. The results of this study indicate that most driveway cross slopes (78.8 percent) exceeded ADA standards and there was no convincing evidence of widespread social inequities. The results highlight priority areas for sidewalk improvements and can be used to inform a transition plan for sidewalk enhancements, namely sidewalk buffer strips.

Conversations About Mental Health and Well-being During the COVID-19 Pandemic: Why and How Restaurant Employees Talk With Each Other and Managers

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ABSTRACT
Restaurant employees in the United States have experienced unprecedented challenges to their mental health and well-being (MHW) during the COVID-19 pandemic, yet little is known about communication regarding MHW in the restaurant industry. Drawing on health, organizational, and interpersonal communication concepts, this exploratory, survey-based study probed whether, how, and why or why not restaurant employees in western Washington State conversed about MHW with one another and their managers during the winter of 2021. Key findings include that there are many reasons why some restaurant employees do not engage in conversations about MHW with other members of the workplace. However, when such conversations do occur, they are typically mutual, positive, and relationally-oriented—more so among coworkers than between employees and managers. Additionally, both coworkers and managers are sources of social support and resource exchange during these conversations, although the evidence is stronger among coworkers. Our findings contribute to the extant literature on mental health communication in the workplace and demonstrate the merit in more closely examining superior-subordinate and coworker communication about personal and sensitive topics, like MHW. Comparative analysis of employees' MHW-related communication with coworkers versus managers revealed both similarities and differences that carry implications for managerial practice and future research.

1. INTRODUCTION
Restaurant employees in the United States have experienced unprecedented challenges to their mental health and well-being (MHW) during the COVID-19 pandemic. Across the board, multiple factors have compounded to have a detrimental effect on American's MHW, including fear of infection with the SARS-CoV-2 virus, social isolation and quarantining, loss of friends and family members, loss of income and employment, and feelings of hopelessness and uncertainty.[1, 2] However, the MHW of individuals working in the restaurant industry is uniquely concerning due to not only these nationwide stressors, but also the new challenges of service work during a pandemic and the significant vulnerabilities restaurant employees endured pre-pandemic.

The restaurant workplace has been transformed by repeatedly-changing government safety regulations intended to protect restaurant employees and their customers, such as social distancing, use of PPE (personal protective equipment), limited seating capacity, and prohibitions on indoor dining.[3–5] Despite such changes, servers, hosts, bussers, and bartenders continued to interact regularly with members of the public for extended periods of time and in close proximity, which increased their risk of exposure to the virus due to the nature of its transmission. Additionally, as front-line employees in boundary-spanning roles, they have had to assume the responsibility of managing hostile customer interactions and enforcing COVID-19 safety regulations.[6–8] The heightened work stress associated with these new burdens is undeniable. Furthermore, work stress is associated with poor MHW.[9, 10] Prior to the pandemic, restaurant employees were especially vulnerable due to challenging work conditions, including low wages, extremely low union membership, emotional exhaustion (fatigue resulting from extreme job or personal demands) and stress, poor MHW associated with irregular time schedules, job insecurity (fear of losing one's job in the future), mistreatment by customers, and high rates of alcohol and drug use relative to other industries.[11–17]

Unsurprisingly, the plight of front-line employees, such as restaurant employees, has recently garnered attention from mainstream media, the public, and scholars alike.[6, 8, 13, 18] Two recent studies point to the importance of examining restaurant employees and

their MHW during the COVID-19 pandemic. Bufquin, *et al.*[3] determined that employees currently working in restaurants experience more psychological distress and drug and alcohol use than employees who are temporarily out of work (*i.e.*, furloughed). Their findings distinguish the pandemic as a unique period because prior research comparing employed and unemployed workers established opposite trends, associating distress and substance use with unemployment. In another study, Chen and Eyoun[19] discovered that employees' "fear of COVID-19", for example, contracting the virus, was positively associated with an important element of burnout: emotional exhaustion. In short, the authors' findings confirm that the pandemic has had a negative impact on restaurant employees' psychological health. Consequently, those authors recommended that restaurants facilitate a supportive work environment by creating "opportunities and channels for frontline employees to voice their fear, concerns/worries about job insecurity, stress, and negative emotions at work anonymously or openly and follow up with them to provide available support."[19]

As communication scholars, we were intrigued by Chen and Eyoun's proposal that managers should encourage their employees to "voice" their concerns related to MHW during the pandemic. They appear to imply that doing so can potentially improve employees' MHW-related outcomes. In other contexts, studies have positively linked various forms of communication with individuals' MHW.[20–22] In the workplace context, one study found that workplace interactions are associated with employee affective states, such that positive interactions are linked to positive affect.[23] That finding indicates that interpersonal interactions, like conversations, are worthy of study. We, similarly, direct our attention to everyday conversations in the workplace, yet choose to focus on the content and nature of these conversations, rather than how they affect MHW. Additionally, the COVID-19 pandemic provides a novel context in which to study interpersonal conversations and the topic of MHW.

The aim of this exploratory, survey-based study was to investigate restaurant employees' conversations about MHW with coworkers and managers. First, we outline and discuss relevant concepts from the field of communication that informed this study and introduce the research questions. Next, we measure the proportion of restaurant employees who reported conversing about MHW with their coworkers and/or managers during the pandemic. For those who reported not having such conversations, we analyze their reasons for not doing so. Third, we examine employees' reports of conversations about MHW. Specifically, we analyze the topics discussed, the communication practices used, and the motives for which employees engaged in these conversations. Finally, we compare the reports of MHW-related conversations with coworkers versus with managers. Our results provide insights for restaurant managers to reconsider how they engage in conversations with their employees about MHW.

2. LITERATURE REVIEW AND RESEARCH QUESTIONS

2.1. Talking about mental health and well-being in the workplace

This study engages concepts from three domains of communication: health, organizational, and interpersonal communication. Prior studies in health communication have explored the disclosure of personal MHW information in the workplace. The World Health Organization (WHO) defines mental health as "a state of well-being in which the individual realizes [their] own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to [their] community."[24] The Centers for Disease Control and Prevention (CDC) adds that it "includes our emotional, psychological, and social well-being."[25] Yet, the CDC also distinguishes "well-being" as a stand-alone term that includes "the presence of positive emotions and moods (*e.g.*, contentment, happiness), the absence of negative emotions (*e.g.*, depression, anxiety), satisfaction with life, fulfillment and positive functioning."[26] These two terms have been used interchangeably in academia and popular media. For the purpose of this study, we combined elements of the WHO and CDC's definitions to construct the following definition of mental health and well-being (MHW): one's psychological, emotional, and social functioning, ability to cope with life stressors, satisfaction with life, and the presence of positive emotions and moods.

Research on MHW in the workplace has mainly focused on work stress or improving employees' MHW from a managerial perspective.[27, 28] A small portion of extant literature in this area examines *communication,* specifically, the disclosure of mental 'illness', 'conditions', or 'disorders' (*i.e.*, diagnosed or receiving treatment) to other work members.[29–31] Such disclosures occur in conversations with others, as an individual communicates information about their illness to a conversational partner.[32] It is well-established that employees may choose to disclose their illness to others to attain support or work accommodations, to explain their behavior, to advocate for or empower themselves, or to educate others.[29, 30, 33] However, there is a dearth of scholarship on workplace communication about common mental health challenges or general MHW. Although such conversations can involve discussing the daily experience of a diagnosed mental illness, they also include non-clinical topics, like stress, relationships, fulfillment, emotions, or substance use. One exception is Irvine's[33] review of two studies commissioned by the United Kingdom's Department of Work and Pensions, in which she concluded that employees *do* talk to others about work stress, emotional/mental distress, or personal life issues, but that they may not necessarily do so in medicalized terms. Irvine's findings challenge the focus of prior research on 'disclosure' and 'illness', thereby questioning a narrow understanding of mental health. Furthermore, she argues that these constructs disregard the expansive continuum of MHW that employees experience, positive and negative, throughout their lives and direct attention away from the reality that MHW requires continual cultivation.[33] Our study responds to

her appeal for further investigation of how employees ordinarily talk about their MHW experiences, through a communication lens.

Another vein of scholarship on MHW in the workplace identifies numerous reasons why employees do *not* discuss such topics with other work members. These include concerns about employment (*e.g.*, being fired, not getting hired), how others perceive them (*e.g.*, dangerous, less credible, competent, or reliable), and others' behavior towards them (*e.g.*, gossip, rejection/exclusion, discrimination, harassment).[29, 30, 33, 34] Additionally, employees may consider the topic of MHW as too private or personal to discuss in work relationships, which can be partially explained by pervasive stigma (*i.e.*, negative/unfavorable attitude) surrounding mental health.[29, 34–36] Finally, the perception that one's mental health problems won't affect one's work or don't merit or require discussion are notable reasons as well.[33] By investigating conversations regarding general MHW, we can reveal which of the aforementioned motivational factors for non-disclosure of clinical MHW information hold true when individuals choose not to discuss general MHW with other work members.

2.2. Communication within workplace relationships
In further reviewing the literature on the communication context of the workplace, it is evident that the other member of an interpersonal conversation and the relationship between the two individuals engaging in conversation is important to consider. That is, whether an individual is discussing MHW with a superior (*i.e.*, supervisor, manager, and employer) or a peer coworker holds implications for the conversation itself. Organizational communication scholarship has investigated the similarities and differences between superior-subordinate (S/S) communication and peer coworker communication.

2.2.1. Superior-subordinate (S/S) communication
Organizational communication scholars have devoted much attention to the relationship between superiors and subordinates.[9] S/S communication is defined as vertical communication transpiring between two individuals, one of whom has formal authority over the other in the organization.[37] Messages communicated downward (*i.e.*, from superior to employee) consist of job instructions, organizational information, and constructive feedback and reinforcement.[38–40] Conversely, superiors also receive messages from their subordinates. This upward communication concerns information about the employees themselves and their coworkers, perspectives on organizational policies and practices, and knowledge about how organizational activities can be executed.[9, 37, 38] The phenomenon of "upward distortion" complicates this communication. When employees are concerned with how others perceive them (*i.e.*, impression management), they may be reluctant to share unfavorable or negative information with their superiors, preferring to impart positive or favorable information.[39, 41] Overall, work-related messages are most prevalent because they are essential to accomplishing tasks. That said, another branch of research suggests that superiors provide employees with support and such dyads exchange relational messages to develop and maintain relationships, trust, and rapport and engage in mutual self-disclosure.[42, 43] Superiors are often the focal point of S/S research, based on scholars' reasoning that effective communication from managers improves organizational outcomes and employees' work life.[44, 45] As a result, the perspectives and experiences of employees have been understudied—our study helps fill this gap.

2.2.2. Coworker communication
Significantly less research has focused on interactions between peer coworkers. This gap in the literature is necessary to fill because the horizontal communication that occurs between coworkers is more frequent than S/S communication.[46, 47] Predictably, information related to tasks is exchanged between coworkers to coordinate work activities.[46, 47] However, many scholars suggest that developing relationships and exchanging social information between coworkers is also important, and that coworkers can enact informal social influence despite their lack of formal authority over each other.[48, 49] Kram and Isabella[50] identified three types of coworker relationships (information, collegial, and special), increasing in their levels of intimacy, self-disclosure, support, and trust. Furthermore, extant scholarship demonstrates that reciprocity and mutuality are significant elements of coworker communication, and that coworkers play an essential role in providing social support.[46, 50] However, the dark sides of coworker communication involve overstepping personal boundaries, incivility, bullying, and manipulation.[46, 47] Fonner's[46] finding that employees are more likely to support one another when they experience negative workplace conditions together is particularly important for our study in light of the difficult work conditions for restaurant employees during the pandemic.

In sum, the literature reviewed thus far indicated many factors that could encourage *or discourage* restaurant employees from talking about MHW in the workplace during the pandemic and also demonstrated why it is important to consider the specific work member, whether managers or coworkers, with whom employees choose or do not choose to discuss such topics. We have also described the topics typically discussed between superiors and subordinates and between coworkers. Therefore, the first two questions we sought to answer in this study were:

Research Question 1: Are restaurant employees having conversations about mental health and well-being with coworkers or managers during the COVID-19 pandemic? If not, why not?

Research Question 2: What topics related to mental health and well-being do restaurant employees report discussing with their coworkers or managers?

2.2.3. Workplace communication is both virtual and in person

Communication between work members increasingly occurs virtually. This is particularly relevant in the period of the pandemic when social distancing practices and concerns about infection increased preference for online communication over in person work meetings. In general, technology, such as e-mail, instant messaging, telephones, and video calls, can be used to send organizational updates and reminders, to clarify or follow up with others, to reach others quickly on urgent matters, or to communicate with offsite or asynchronous employees.[51, 52] While virtual communication yields many benefits, studies on S/S communication have demonstrated that in-person interaction is preferred for developing relationships and exchanging sensitive or personal information.[51–53] Previous research has indicated that coworkers use social media platforms, like Facebook, to connect and communicate with each other, both at work and outside of work, and that online interactions have an impact on employees' experience in the workplace.[54–56] Considering the shift in trends toward online work-related communication generally during the pandemic in combination with the physical presence required of restaurant employees to provide their services to customers, we were curious to discover whether employee conversations about MHW occur in person or in virtual spaces via digital technologies. Considering the literature reviewed thus far, the third research question and related sub questions we sought to answer were:

Research Question 3: When and how do restaurant employees report discussing mental health and well-being with their coworkers or managers?

Research Question 3a: Do these conversations occur during work hours, outside of work hours, or both?

Research Question 3b: Do these conversations occur in person at work, in person outside of work, or virtually?

Research Question 3c: Who initiates these conversations? Do employee respondents, their coworkers, or managers initiate them? Or are they mutually initiated by all conversational partners?

2.3. Interpersonal communication in the organization

Having established that employees engage in interpersonal communication to exchange messages and achieve social goals with their superiors and coworkers, we employ the concepts of social exchange, social support, and Interpersonal Communication Motives (ICM) to enrich understanding of interpersonal communication in work settings and thus refine the conceptual framework of this study. Specifically, these concepts help us interpret why restaurant employees might discuss MHW with their coworkers or managers.

2.3.1. Social exchange

Social exchange refers to mutual and reciprocal give and take of resources between two individuals that results in a sense of obligation and interdependence, which is pivotal to the development and maintenance of a high quality, positive relationship.[57] In exchange relationships with superiors, employees provide good "performance" and expert skills for which superiors return positive reviews, recognition, salary bonuses, and positional resources.[46] Coworkers exchange resources like organizational and social information, friendliness, and social support.[46]

2.3.2. Social support

Social support, closely tied to social exchange, is defined as "information leading the subject to believe that [they are] cared for and loved, esteemed, and a member of a network of mutual obligations."[58] Coworkers are an important and effective source of social support because of the extensive amount of time spent together and ability to understand and empathize with each other's challenges and work experiences.[47] Superior-provided social support has been importantly linked to employee MHW, especially in outcomes related to work. For example, in Hämmig's[59] study on sources of social support at work, he found that a lack of social support from one's superior had a negative effect on burnout and job satisfaction. Because social support is positively associated with MHW,[60] we were intrigued to learn how social exchange and social support play a role in restaurant employees' conversations about MHW.

2.3.3. Interpersonal Communication Motives (ICM)

We know from the work of many interpersonal communication scholars that communication serves many functions. We

previously established specific reasons for the disclosure of mental illness in *Talking about mental health and well-being in the workplace*, like acquiring work accommodations or providing explanations for one's behavior. While these specific reasons for disclosure are important, we considered them to be strongly applicable in the context of conversations about clinical illness, and questioned how effective this short list would be in revealing more profound reasoning for why employees engage in conversations about general MHW topics, like relationships and emotions. In searching the literature about reasons for communicating interpersonally generally, we reasoned that the concept of Interpersonal Communication Motives (ICM) was better suited for this study, especially considering that it has been utilized in workplace research in the past. The concept of ICM identifies why people initiate conversations with others and can be applied to different contexts. This concept assumes that people communicate to fulfill needs, and when an individual purposely engages in conversation with another to meet these needs, they are manifested in motives (*i.e.*, reasons) for communicating. Another important assumption incorporated in this concept is that individuals are aware of their motives and can report them. Utilizing this concept in our study, we can better understand the underlying needs that incentivize employees to initiate conversations about general MHW with other work members.

Motives	Corresponding statements "I talk to people…"
1. Pleasure	1.1 Because it's fun. 1.2 Because it's exciting. 1.3 To have a good time. 1.4 Because it's thrilling. 1.5 Because it's stimulating. 1.6 Because it's entertaining. 1.7 Because I enjoy it. 1.8 Because it peps me up.
2. Affection	2.1 To help others. 2.2 To let others know I care about their feelings. 2.3 To thank them. 2.4 To show others encouragement. 2.5 Because I'm concerned about them.
3. Inclusion	3.1 Because I need someone to talk to or be with. 3.2 Because I just need to talk about my problems sometimes. 3.3 Because it makes me feel less lonely. 3.4 Because it's reassuring to know someone is there.
4. Escape	4.1 To put off something I should be doing. 4.2 To get away from what I'm doing. 4.3 Because I have nothing better to do. 4.4 To get away from pressures and responsibilities.
5. Relaxation	5.1 Because it relaxes me. 5.2 Because it allows me to unwind. 5.3 Because it's a pleasant rest. 5.4 Because it makes me feel less tense.
6. Control	6.1 Because I want someone to do something for me. 6.2 To tell others what to do. 6.3 To get something I don't have.

Table 1. Interpersonal Communication Motives.

Rubin, Perse and Barbato[61] developed an ICM scale that identifies six main motives for communicating: (a) pleasure—because it is fun and stimulating, (b) affection—to express caring and appreciation for others, (c) inclusion—to be with and share with others, (d) escape—to avoid other activities or communicate to fill time, (e) relaxation—to rest and unwind, and (f) control—to gain others' compliance. To measure these motives, Rubin, Perse and Barbato[61] developed a list of 28 statements corresponding to the six main motives (**Table 1**).

In a later study, Barbato, Graham, and Perse[62] categorized the motives of affection, pleasure, inclusion, and relaxation as relationally-oriented, that is, they reveal an intention to engage in positive and friendly interactions with others. On the other hand, the motives of control and escape are categorized as personal-influence motives, that is, they reveal an intention to manage and control interactions with others. Again, we argue that ICM is better suited to this study when we consider how employees develop relationships and exchange social information with their coworkers, and how they are under the formal influence of their managers. Indeed, the application of ICM to organizational contexts has proven useful in the past. For example, Anderson and Martin[63] found that employees communicate with their superiors for the motives of inclusion and affection, and that they communicate with their coworkers for affection. In another study, Graham, Barbato and Perse[64] found that individuals are more likely to communicate with coworkers for relaxation when compared to other relationships (*e.g.*, spouses, strangers).

Investigating restaurant employees' motives for communicating about MHW with their coworkers or managers helps to illuminate several aspects of such conversations. First, individuals' motives for communicating reveal whether conversations are relationally-oriented or concern personal-influence. Furthermore, the similarities between the affection motive (*i.e.*, showing care and appreciation) and the concept of social support (*i.e.*, leading the subject to believe that they are cared for and loved) provide insight as to whether discussing MHW is a way to partake in social support. Third, by employing the concept, the language used in specific corresponding statements sheds light on social exchange. Some statements are self-oriented, which indicates receiving a resource from another person (*e.g.*, "because it makes me feel less tense"). Other statements are other-oriented, which indicate providing a resource to another person (*e.g.*, "to show others encouragement"). Finally, since affection and inclusion have been identified as more personal motives satisfied by more intimate relationships,[64] respondents' reports of these motives help to distinguish between the types of relationships restaurant employees have with their coworkers and managers. In view of these affordances of the ICM motives, the fourth research question is:

> Research Question 4: What are restaurant employees' motives for discussing mental health and well-being with their coworkers or managers?

2.4. Comparative differences
The demonstrated similarities and differences between S/S and coworker communication outlined in *Communication within workplace relationships* lead us to our final research question:

> Research Question 5: How do the results of RQs 2–4 compare in conversations about mental health and well-being between coworkers versus those between employees and managers?

3. METHODS AND PROCEDURES
3.1. Sample and procedure
To answer the questions guiding this study, we conducted an anonymous online survey through which we collected self-reports from restaurant employees in western Washington State. Respondents were recruited through snowball sampling. The region and recruitment method were selected to account for the limited resources and time constraints present in an undergraduate research thesis. We distributed a survey link via email to organizations found online that represent and/or support restaurant employees in western Washington. We posted the survey link on social media, as well as sending it through direct messaging to personal contacts. Finally, we distributed flyers in multiple restaurant districts of western Washington through in person visits. This research design was approved by the Institutional Review Board at the University of Washington (STUDY00012150).

Required screening questions at the beginning of the survey determined eligibility. Respondents who were (a) currently employed, full-time or part-time, at a restaurant in western Washington, (b) engaging with the public face-to-face during working hours, and (c) not in managerial positions were eligible to participate in the study and permitted to complete the rest of the survey. During the six weeks the survey was available online in January, February, and March 2021, a total of 100 eligible respondents completed the survey. A set of optional demographic questions identified respondents' characteristics (results shown in **Table 2**). The survey led respondents through the same series of questions twice, once regarding their conversations with coworkers during the last six months (*i.e.*, since the summer of 2020) and then a second time regarding their conversations with managers during that period, to allow for comparison. In each of the two series, the first question asked whether the respondent had conversations about MHW with the relevant work member. When answered "yes", the survey led the respondent through the full series of question regarding

their conversations to answer RQs 2–4. When answered "no", the survey presented only one additional question in that series to identify reasons for not engaging in such conversations. There were no open-ended questions, but respondents could enter text when they selected an "Other" response option to specify or elaborate their response.

Characteristic		N	%
Full/Part-time	Full-time	32	32%
	Part-time	68	68%
Position*	Host	2	2%
	Server/waiter	74	74%
	Bartender	7	7%
	Cook/chef	4	4%
	Other	12	12%
Ethnic identity**	Black/African American	3	3%
	Asian	14	14%
	White	82	82%
	Native Hawaiian/Other Pacific Islander	0	0%
	Hispanic/Latino	9	9%
	American Indian/Native Alaskan	4	4%
	Other/Unknown	3	3%
Gender	Female	72	72%
	Male	18	18%
	Non-binary	10	10%
Age	18-25	53	53%
	26-35	23	23%
	36-45	18	18%
	46-55	5	5%
	56-65	1	1%
	66+	0	0%

Table 2. Characteristics of respondents who completed the survey ($N = 100$). *Percentage adds up to less than 100% as response was optional. **Percentage adds up to more than 100% as respondents could select more than one response.

3.2. Response options and measures

To generate data corresponding to our research questions, we developed a series of close-ended survey questions with predetermined response options based on the extant literature reviewed above. Our survey defined "mental health and well-being" for respondents as one's psychological, emotional, and social functioning, ability to cope with life stressors, satisfaction with life, and the presence of positive emotions and moods. The list of MHW topics presented in the survey was derived from the CDC and WHO's online materials and resources.[24–26] Additionally, our predetermined list of potential reasons for not talking about MHW was drawn from extant research on disclosure of mental health in the workplace. The specific phrases of "less competent, reliable, or able to cope," "treated differently," and "dismissed from job" were directly adopted from Irvine.[33] The original Interpersonal Communication Motives scale consists of 28 statements corresponding to six motives.[61, 64] We narrowed this down to 16 statements to reduce redundancy and then adapted the semantics of some statements to the work context and topical focus of this study, *i.e.*, restaurants and MHW. **Table 3** presents motives and corresponding statements employed in our adaptation of the ICM scale. Participants rated the extent to which they agreed with each statement using a 5-point Likert scale (Strongly agree = 1, Strongly disagree = 5).

Motives	Corresponding statements "I talk with my coworker(s)/my manager(s) about mental health and well-being…"	
1. Pleasure	1.1	Because I enjoy it.
2. Affection	2.1	Because I'm concerned about them.
	2.2	To help others with whatever they need help with.
	2.3	To let others know I care about their feelings.
	2.4	To thank them (for example, thank them for supporting me, thank them for listening, *etc.*)
	2.5	To show others encouragement.
3. Inclusion	3.1	Because I just need to talk about my problems sometimes.
	3.2	Because it makes me feel less lonely.
	3.3	Because I need someone to talk to.
4. Escape	4.1	Because I have nothing better to do (for example, work is slow, no customers are in the restaurant, there are no work tasks to complete, *etc.*)
	4.2	To put off something I should be doing (such as completing a work task, getting help from a professional therapist, having a conversation with someone in my life about mental health, *etc.*)
	4.3	To get away from what I'm doing (such as completing a work task, attending to customers, *etc.*)
5. Relaxation	5.1	Because it makes me feel less tense.
	5.2	Because it allows me to unwind.
6. Control	6.1	To get something I don't have (such as getting time off from work, getting my shift covered, *etc.*)
	6.2	To tell others what to do (for example, telling them what they should do about their mental health, *etc.*)

Table 3. Motives for communicating about mental health and well-being.

Survey data were analyzed through basic statistics for this exploratory study: frequencies, ranges, and averages were calculated for each question, and the data on inter-coworker versus employee-manager conversations were compared closely. Regarding the motives for communicating, averages were calculated when there were multiple corresponding statements. The result is a descriptive analysis of data derived from previously established frameworks.

4. RESULTS
Regarding RQ 1, the first section focuses on whether restaurant employees have had conversations about MHW with their coworkers or managers, and if they haven't, what their reasons are. A majority of respondents (80%) reported talking about MHW with either coworkers, managers, or both. Differentiating further: 34% of respondents talked to both coworkers and managers, 43% talked to their coworkers but not their managers, and 3% talked to their managers but not their coworkers (see **Figure 1**). A sizeable minority, *i.e.*, 20% of respondents, reported that they did not talk to anyone at work about MHW. Of the 80 respondents who discussed MHW with somebody from work, most (96.3%; $n = 77$) had conversations with coworkers and around half (46.3%; $n = 37$) had conversations with managers. It is important to note that these two groups are not mutually exclusive as they overlap in those respondents who talked to both coworkers and managers.

Next, we present reasons respondents provided to explain why they did not have conversations about MHW with coworkers and with managers. Out of all 100 respondents, 23% reported that they did not have conversations with coworkers, while 63% reported that they did not have conversations with managers. Again, it is important to note that these two groups are not mutually exclusive as they overlap in those respondents who talked to no one, *i.e.*, neither their coworkers nor their managers. **Figure 2** and **Figure 3** depict the wide range of reasons respondents provided. Of the respondents who did not discuss MHW with coworkers ($n = 23$), over a third selected the following reasons: "It would feel awkward" (52.2%), "I've never considered doing so" (47.8%), "Those aren't topics that get discussed with coworkers where I work" (47.8%), "I don't want attention" (39.1%), and "I don't want to be perceived as less competent, reliable, or able to cope" (39.1%). Of respondents who did not discuss MHW with managers ($n = 63$), over a third selected the following reasons: "It would feel awkward" (60.3%), "I don't want to discuss

those topics with my manager(s)" (50.8%), "Those aren't topics that get discussed with managers where I work" (38.1%), "I've never considered doing so" (38.1%), "I don't want to be treated differently" (34.9%), "I don't want to be perceived as less competent, reliable, or able to cope" (34.9%), and "I've never needed to" (33.3%).
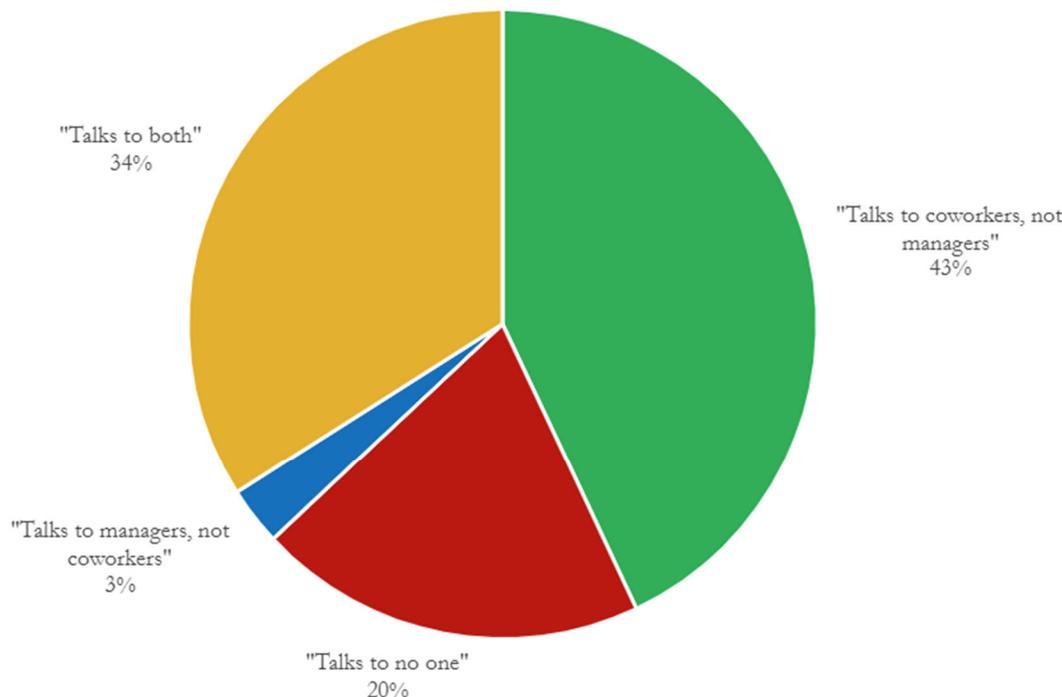

Figure 1. The proportion of respondents' conversational partners in conversations about MHW in the past six months ($N = 100$).

To answer RQs 2–4, we analyzed MHW topics discussed in conversations, when and how conversations occurred, and respondents' motives for their conversations. We first present the results on respondents' conversations with coworkers, then respondents' conversations with managers.

4.1. Conversations with coworkers
The following results pertain to the subset of respondents who reported having had conversations about MHW with coworkers in the past six months ($n = 77$).

4.1.1. Topics discussed
Respondents identified a wide variety of MHW-related topics discussed with their coworkers. The most frequently reported were work stress (87%), COVID-specific concerns (high-risk work environment, family and friends, "bubbles," *etc.*) (80.5%), negative emotions (sadness, anger, *etc.*) (79.2%), and burnout (74%). Just one write-in response was provided: "Feeling that society and the government views us as disposable."

4.1.2. When and how conversations occurred
Over half of these respondents (61%) reported that conversations occurred both during and outside of their work hours. Over a third (36.4%) reported conversations during their work hours only, and just 2.6% reported conversations outside of their work hours only. Almost all respondents reported that such conversations took place in person at the workplace (98.7%), 53% reported conversations also took place virtually, and 31.2% reported conversations with coworkers in person outside of the workplace. Nearly all respondents (96.1%) indicated that conversations were mutually initiated, while two reported they personally initiated the conversations, and one reported their coworkers did.
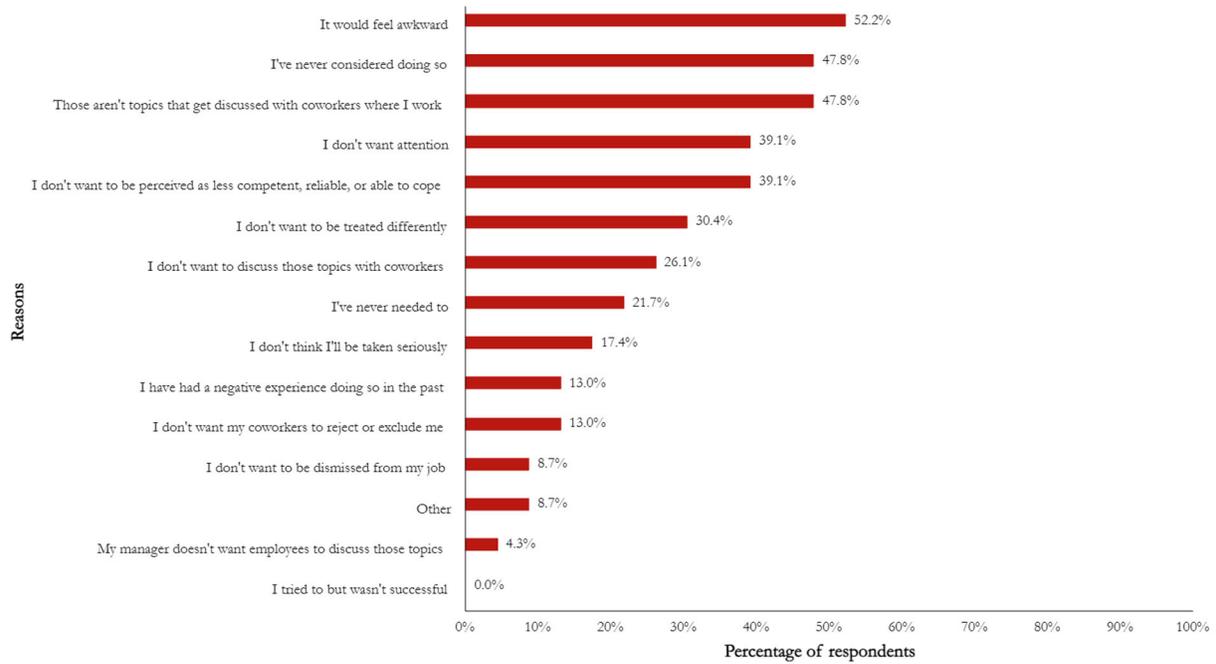
Figure 2. Respondents' reasons for not discussing mental health and well-being with coworkers ($n = 23$).
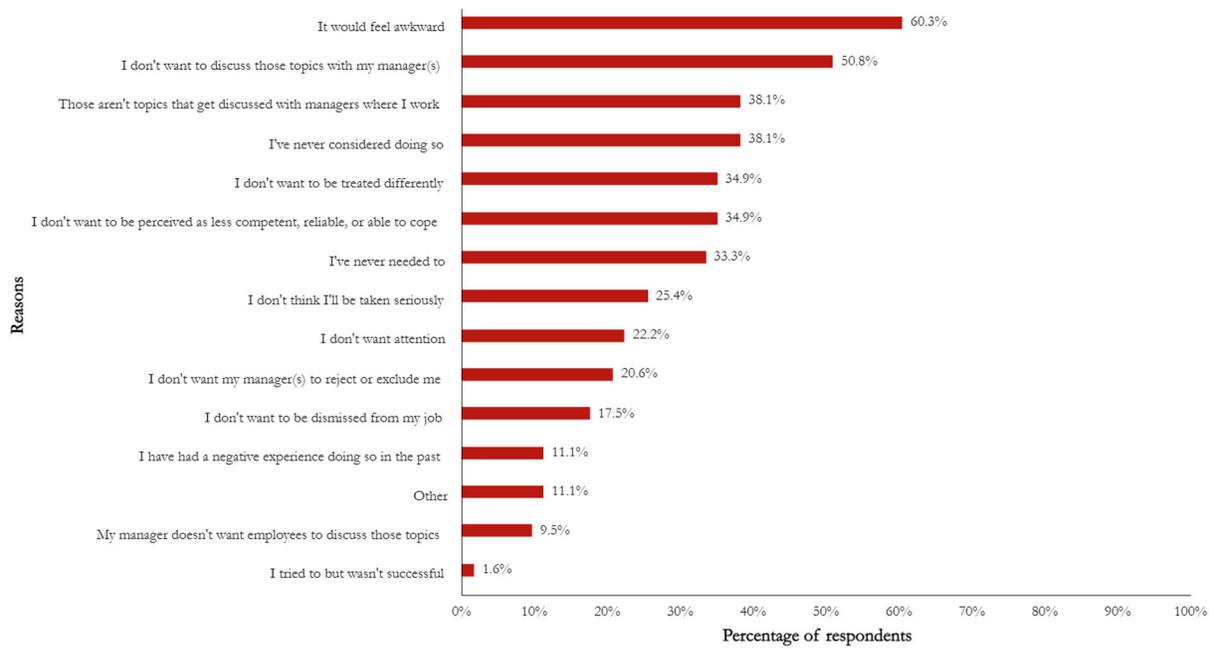

Figure 3. Respondents' reason for not discussing mental health and well-being with managers ($n = 63$).

Motives	Answer				
	Strongly agree	Agree	Agree and disagree	Disagree	Strongly disagree
Pleasure	18.2% (14)	39% (30)	28.6% (22)	11.7% (9)	2.6% (2)
Affection	26.5% (20.4)	56.9% (43.8)	11.2% (8.6)	3.6% (2.8)	1.8% (1.4)
Inclusion	18.6% (14.3)	48.9% (37.7)	16.9% (13)	11.3% (8.7)	4.3% (3.3)
Escape	9.5% (7.3)	16% (12.3)	15.6% (12)	36.8% (28.3)	22.1% (17)
Relaxation	11.7% (9)	41.6% (32)	28.6% (22)	14.3% (11)	3.9% (3)
Control	1.3% (1)	9.1% (7)	11% (8.50)	42.9% (33)	35.7% (27.5)

Table 4. Respondents' motives for talking about mental health and well-being with a coworker(s) (*n* = 77). Answers are presented as: % (*n*).

4.1.3. Motives
The average frequencies of the statements corresponding to each motive are shown in **Table 4**. Affection and inclusion were the motives with the highest averaged frequencies of agreement and strong agreement. In contrast, the averaged frequencies of disagreement and strong disagreement were highest for the motives of control and escape. Although the averaged frequencies lean toward agreement with the motives of pleasure and relaxation, the data evidence some ambivalence among respondents regarding those motives.

The following seven statements were evaluated positively (*i.e.*, agree or strongly agree) by over two thirds of respondents:
- "I talk with my coworker(s) about mental health and well-being to let others know I care about their feelings." (93.5%)
- "I talk with my coworker(s) about mental health and well-being to show others encouragement." (88.3%)
- "I talk with my coworker(s) about mental health and well-being to help others with whatever they need help with." (83.1%)
- "I talk with my coworker(s) about mental health and well-being because I'm concerned about them." (81.9%)
- "I talk with my coworker(s) about mental health and well-being because I just need to talk about my problems sometimes." (75.4%)
- "I talk with my coworker(s) about mental health and well-being to thank them (for example, thank them for supporting me, thank them for listening, *etc.*)" (70.2%)
- "I talk with my coworker(s) about mental health and well-being because it makes me feel less tense." (67.6%)

4.2. Conversations with managers
The following results pertain to the subset of respondents who had conversations about MHW with managers in the past 6 months (*n* = 37).

4.2.1. Topics discussed
Respondents reported discussing a variety of MHW-related topics with their managers. The topics most frequently reported were COVID-specific concerns (high-risk work environment, family and friends, "bubbles," *etc.*) (78.4%), work stress (67.6%), negative emotions (sadness, anger, *etc.*) (54.1%), and burnout (51.4%). Two respondents each wrote-in an additional topic: "Social battery (such as needing time to self to recharge)," and "How we can better be a team."

4.2.2. When and how conversations occurred
A majority of these respondents (73%) reported that conversations took place during work hours only, and 27% reported conversations took place both during and outside of work hours. All of these respondents indicated such conversations occurred in person at the workplace, while 32.4% and 16.2% reported conversations with managers also took place virtually and in person outside of the workplace respectively. One respondent noted that their conversations with their manager occurred via third party translation. Over half of respondents (64.9%) indicated conversations were mutually initiated, while 29.7% reported just they

initiated. Only two respondents reported that their manager had initiated conversations about MHW with them even though they did not initiate such conversations themselves.

4.2.3. Motives
The average frequencies of the statements corresponding to each motive are shown in **Table 5**. When reviewing this data, it is important to note that a typographical error in this question was fixed soon after the survey was posted online. When originally published, this survey question incorrectly included "coworkers", which was later corrected to "managers." For this reason, the 10 answers submitted before the correction were excluded from analysis, resulting in 27 valid responses instead of 37 for this item.

Motives	Answer				
	Strongly agree	Agree	Agree and disagree	Disagree	Strongly disagree
Pleasure	11.1% (3)	29.6% (8)	22.2% (6)	25.9% (7)	11.1% (3)
Affection	15.5% (4.2)	48.2% (13)	17% (4.6)	11.9% (3.2)	7.4% (2)
Inclusion	6.2% (1.7)	55.6% (15)	17.3% (4.7)	16.1% (4.3)	4.9% (1.3)
Escape	2.5% (0.7)	7.4% (2)	6.2% (1.7)	50.6% (13.7)	33.3% (8.3)
Relaxation	5.6% (1.5)	37% (10)	29.6% (8)	18.5% (5)	9.3% (2.5)
Control	0% (0)	11.1% (3)	14.8% (4)	46.3% (12.5)	29.6% (8)

Table 5. Respondents' motives for talking about mental health and well-being with a manager(s) (n = 27). Answers are presented as: % (n).

Affection and inclusion are the motives with the highest averaged frequencies of agreement and strong agreement. In contrast, control and escape are the motives with the highest averaged frequencies of disagreement and strong disagreement. Respondents evidenced ambivalence towards the motives of pleasure and relaxation.

The following four statements were evaluated positively (*i.e.*, agree or strongly agree) by over two thirds of respondents:
- "I talk with my manager(s) about mental health and well-being to let others know I care about their feelings." (70.4%)
- "I talk with my manager(s) about mental health and well-being to help others with whatever they need help with." (66.7%)
- "I talk with my manager(s) about mental health and well-being to thank them (for example, thank them for supporting me, thank them for listening, *etc.*)" (66.7%)
- "I talk with my manager(s) about mental health and well-being because I need someone to talk to." (66.7%)

4.3. Comparing conversations with coworkers and with managers
In light of the literature reviewed for this study, it is important to compare similarities and differences in respondents' conversations about MHW with coworkers versus with managers. To answer RQ 5, we compare respondents' reports of conversations with coworkers and with managers side by side. The following section presents a descriptive comparison of the MHW topics discussed in these different conversations, when and how these conversations occur, and respondents' motives for talking to coworkers versus managers.

4.3.1. Comparing topics
Overall, respondents who conversed with coworkers (n = 77) and those who conversed with managers (n = 37) reported talking about the same top five topics, with slightly different frequency: (a) work stress, (b) COVID-specific concerns, (c) negative emotions, (d) burnout, and (e) job satisfaction (see **Figure 4** and **Figure 5**). While the most frequently cited topic when talking with coworkers was work stress, the most frequently cited topic when talking with managers was COVID-specific concerns. Significantly, these respondents discussed a wider variety of topics with coworkers more frequently than they did with managers.

Over half of respondents who had conversations with coworkers discussed work stress (87%), COVID-specific concerns (80.5%), negative emotions (79.2%), burnout (74%), job satisfaction (63.6%), mental illness/disorders (62.3%), and the ability to juggle multiple aspects of life (55.8%). On the other hand, over half of respondents who had conversations with managers discussed COVID-specific concerns (78.4%), work stress (67.6%), negative emotions (54.1%), and burnout (51.4%).
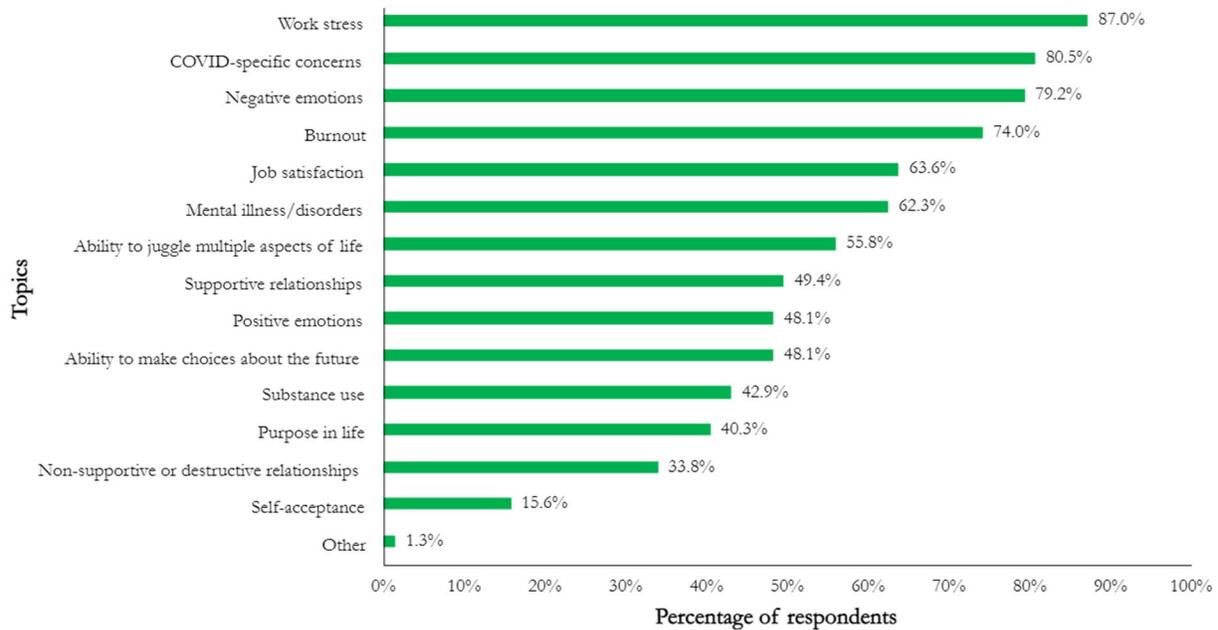
Figure 4. Topics discussed in conversations with coworkers (*n* = 77).
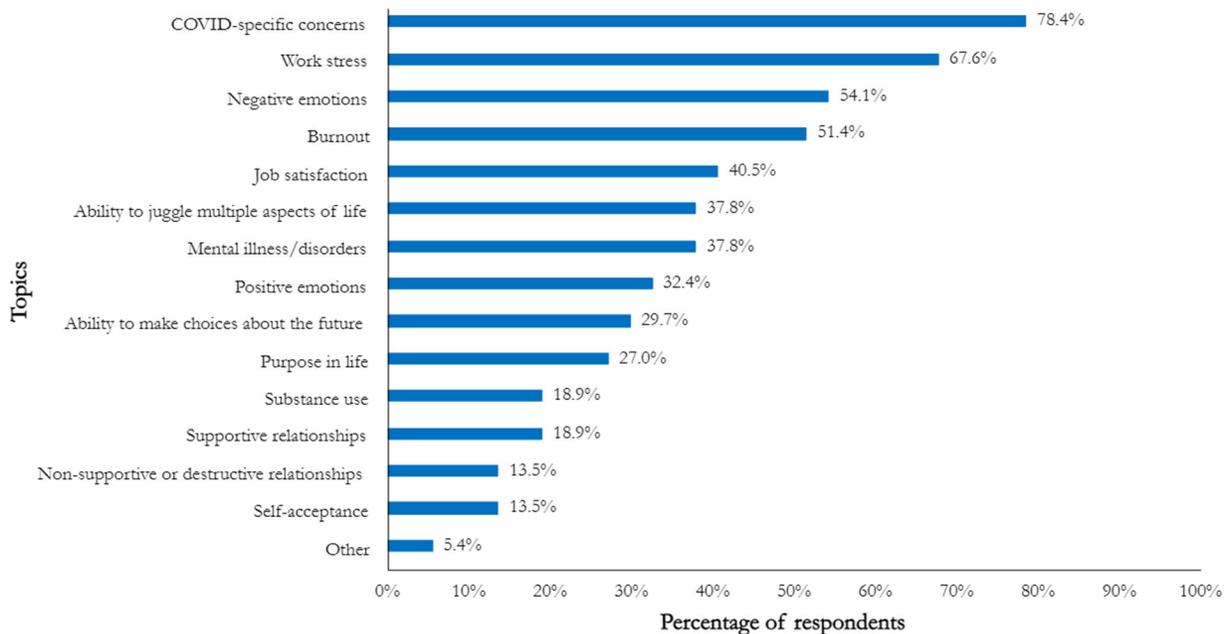
Figure 5. Topics discussed in conversations with managers (*n* = 37).

4.3.2. Comparing when and how conversations occurred
Figure 6, **Figure 7**, and **Figure 8** compare respondents' reports of when conversations occur, how conversations take place, and who initiates conversations with coworkers and with managers, respectively. Responses provided by respondents were more varied regarding conversations with coworkers than conversations with managers. Coworkers discussed MHW among themselves during and outside of work hours, as well as in person at the workplace, in person outside of the workplace, and virtually.

Conversations about MHW with managers were more likely to take place in person at work and least likely in person outside of work. The initiation of conversations with managers was more varied than those with coworkers. Most restaurant coworkers mutually initiated conversations about MHW. While many conversations between employees and managers were also mutual, more employees initiated such conversations with their managers than managers did with them.
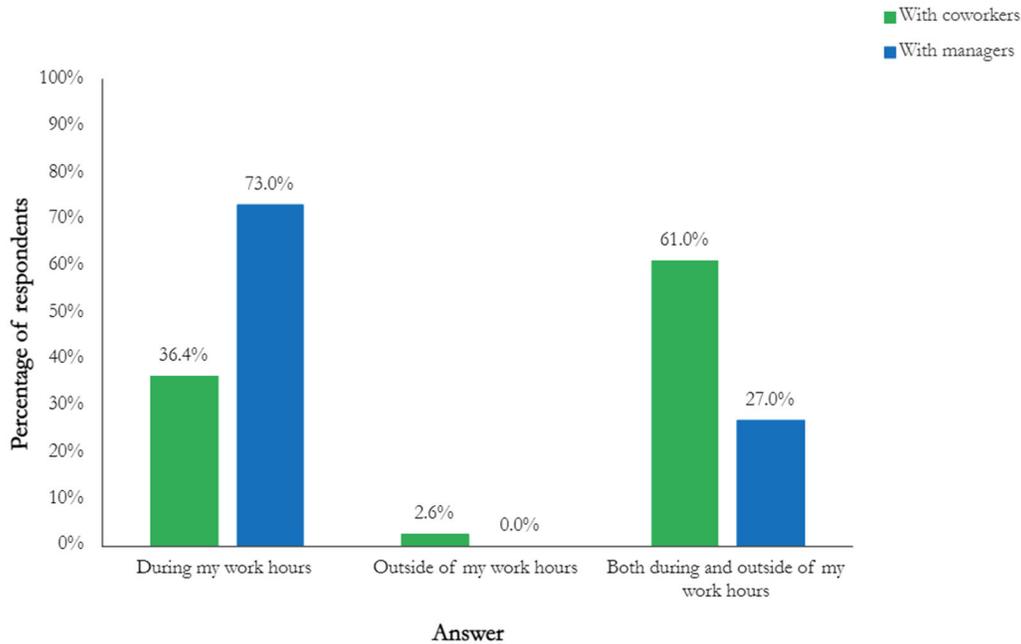
Figure 6. A comparison of when conversations occur with coworkers and with managers (Respondents who talk to coworkers: $n = 77$; Respondents who talk to managers: $n = 37$).
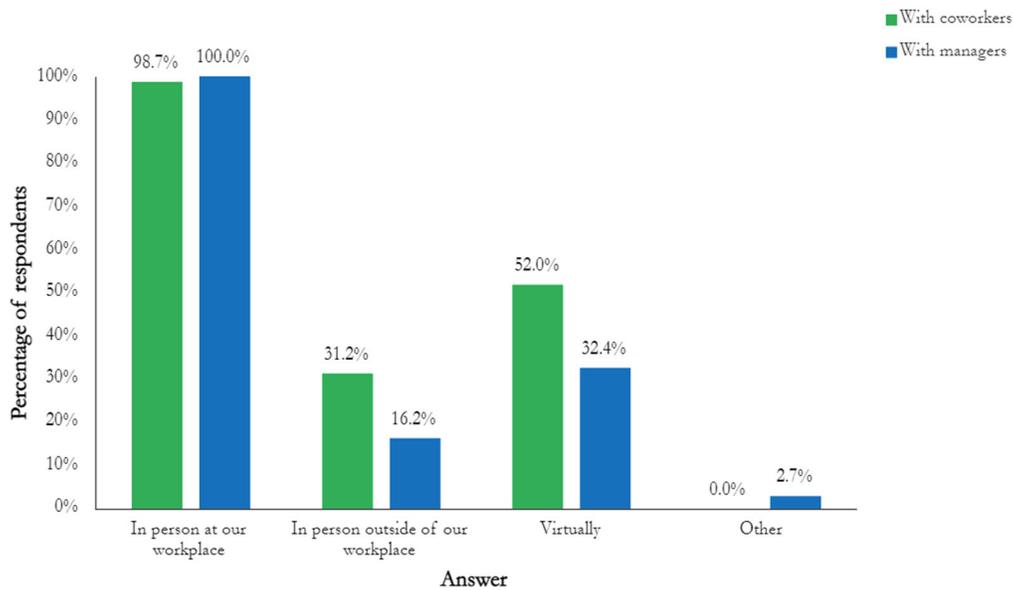
Figure 7. A comparison of how conversations occur with coworkers and with managers (Respondents who talk to coworkers: $n = 77$; Respondents who talk to managers: $n = 37$).
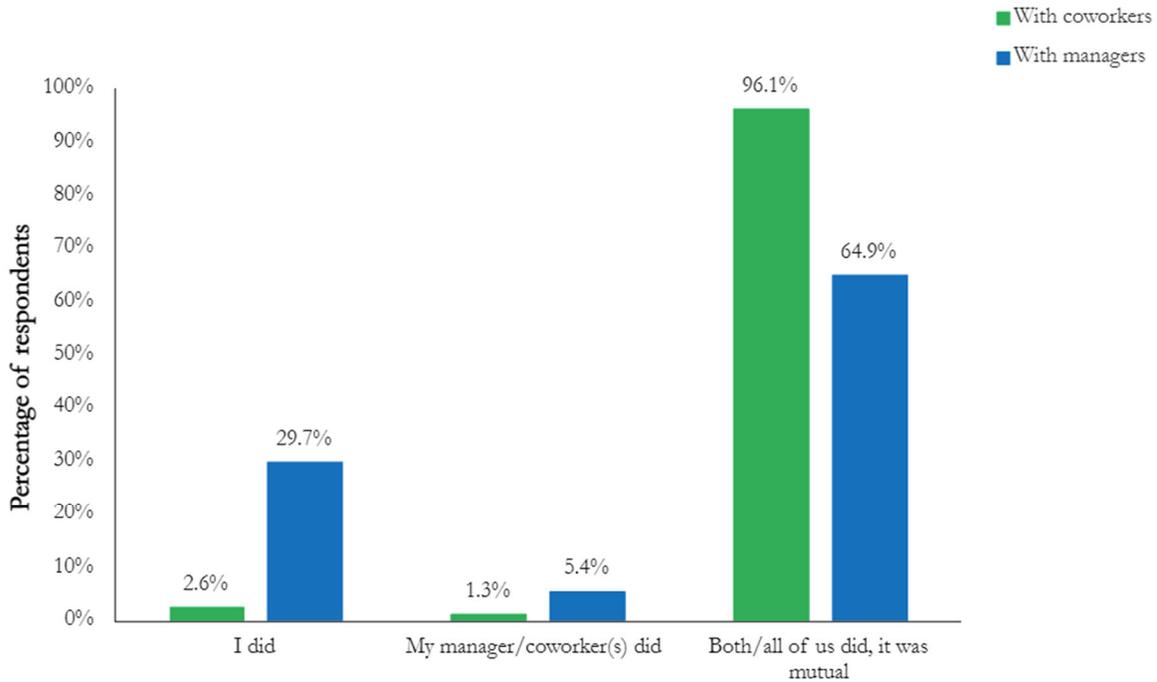
Figure 8. A comparison of who initiates conversations with coworkers and with managers (Respondents who talk to coworkers: $n = 77$; Respondents who talk to managers: $n = 37$).

4.3.3. Comparing motives

Figure 9 compares respondents' motives for discussing MHW with coworkers and with managers. Respondents primarily talked about MHW with their coworkers for affection and inclusion, with some evidence pointing to relaxation and pleasure too. Respondents were also motivated by affection and inclusion in their conversations with managers, although the evidence is weaker.
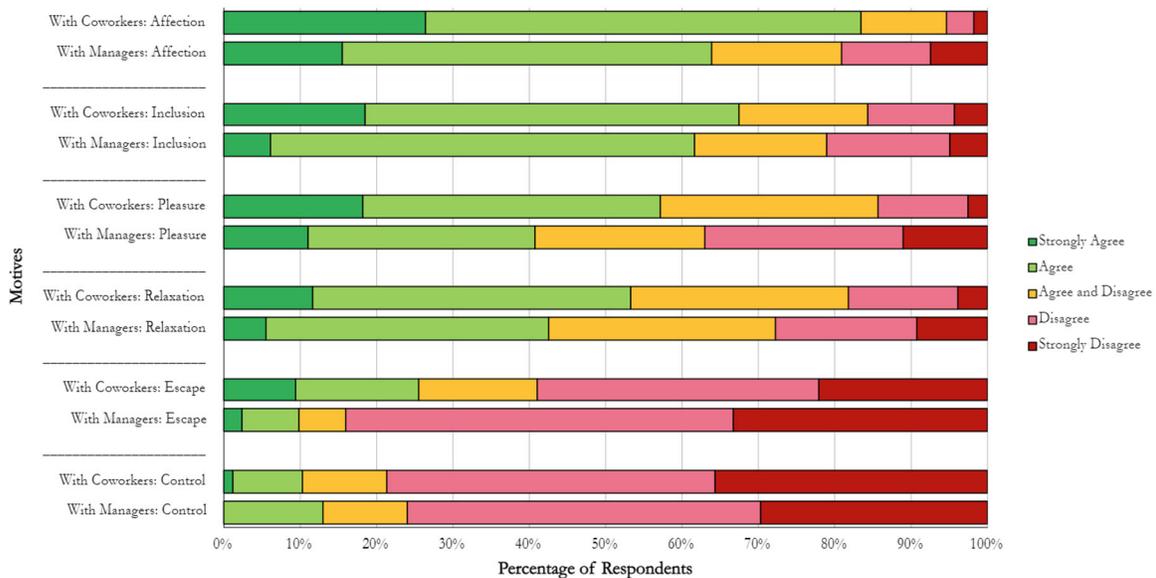
Figure 9. A comparison of respondents' motives for talking about mental health and well-being with coworkers and with managers (Respondents who talk to coworkers: $n = 77$; Respondents who talk to managers: $n = 27$).

5. DISCUSSION

Our study confirms that most restaurant employees talked about MHW with coworkers and managers during the COVID-19 pandemic, but they were much more likely to talk to their coworkers than to their managers. This result is partially explained by workplace communication patterns in that employees spend more time with their coworkers than they do with their superiors.[46] It may also hint at restaurant employees' preferences for conversational partners when discussing sensitive topics, like MHW.

5.1 Reasons for not discussing MHW with coworkers and managers

Restaurant employees cited noteworthy reasons that discouraged or prevented them from discussing MHW. For some, norms or expectations against discussing MHW in the workplace precluded such conversations with either coworkers or managers. Other reasons cited by restaurant employees indicate concern about their social relationships, and specifically how they are perceived and treated by others. Regarding conversations with coworkers, these reasons can be explained by the role of peer coworkers' informal social influence and the importance of relationship development with coworkers found in prior research on coworker communication.[48, 49] Regarding conversations with managers, these reasons suggest employees' concern about their status as subordinates. Extant literature confirms that employees find relationship development with their superiors to be important.[42, 43] Interestingly, respondents indicated that they did not want to talk about MHW with managers, while at the same time, this reason was not significant regarding conversations with coworkers. Prior research has established the phenomenon of 'upward distortion', which may explain this finding.[39, 41] Most often, restaurant employees did not talk to coworkers or managers about MHW because it would feel awkward, confirming this and other studies' assumption that MHW is a sensitive and personal topic. While our study could not pinpoint exactly what precipitates the awkwardness, previous research on disclosure of mental health in the workplace implicates stigma.[29–31, 33, 34] All reasons frequently provided by respondents align with the concerns and reasons for non-disclosure found in prior research regarding MHW in the workplace.[29, 30, 33, 34] Contrary to this body of research, concerns regarding employment, *e.g.*, fear of dismissal, was not a response frequently provided by the respondents in our study.[29, 30, 33, 34] This finding may indicate that once hired, restaurant employees are less concerned about discussing MHW, however, it does not provide insight into conversations with potential employers about MHW prior to hiring. Overall, our findings suggest that concerns regarding conversations about MHW in the restaurant workplace involve the consideration of norms, relationship development, and stigma.

5.2. Topics

The fact that COVID-specific concerns dominated conversations with coworkers and managers is unsurprising in view of the pandemic's devastating impacts on the restaurant industry and its employees. Our results indicate that many conversations about MHW were focused on the work sphere. For example, restaurant employees may discuss their high-risk work environment, work stress, job satisfaction, negative emotions like frustration about work schedules or anger regarding noncompliant customers, or burnout due to busy schedules or short staff. On the other hand, topics like negative emotions and burnout may originate from non-work spheres of life, such as interpersonal relationships, family dynamics, school, or psychological challenges. The findings also reveal that restaurant employees discuss a wider variety of topics with their coworkers than with managers. Again, several elements of coworker communication support this, including the greater amount of time spent together, a lack of hierarchical difference in status, and the ability to understand and empathize with each other's challenges and work experiences.[47, 50] Contrary to the well-established phenomenon of upward distortion, it is interesting that so many employees discussed negative emotions and work stress with managers, while fewer discussed positive emotions, supportive relationships and self-acceptance.[37] Finally, the topics discussed by restaurant employees overall align with Irvine's[33] finding that employees discuss mental health at work in non-medicalized terms and further validates her argument that research conducted on mental health communication in the workplace ought to approach the concept as an expansive continuum of positive and negative experiences, rather than narrowly defined experiences of 'illness' or 'disorder.'

5.3. When and how conversations occurred

For the employees who did converse about MHW, our findings demonstrate when and how they occurred, and who initiated such conversations. First, the findings suggest that restaurant employees discuss MHW with one another not only at the workplace, but also outside of the workplace, outside of work hours, and via technology. This wide variety of settings and ways in which conversations occur is unsurprising in view of extant literature on coworker communication. It is well-established that coworkers exchange social and personal information with one another at work.[46, 50] Additionally, a growing body of research investigating coworker connection via social media suggests that employees do interact virtually for not only organizational purposes, but for personal and relationship-building purposes as well.[54–56] Future research should investigate how employees use different virtual channels to discuss personal topics, like MHW, as this study does not expand on the term "virtually." A small group of respondents reported interacting with coworkers in person outside of work, an interesting finding that is not supported or investigated in any other research. Overall, our results imply that restaurant employees discussing MHW are undeterred by a formal work environment and are motivated to discuss personal topics virtually. Another possibility may be that the restaurant workplace is considered more casual, intimate, and relatively conducive to disclosing personal information, however, there is no

other research on organizational culture in the restaurant workplace to support this. Respondents reported a high rate of mutual conversations among coworkers, suggesting that restaurant employees are open-minded and receptive to discussing MHW topics, especially with their peers. This element of mutuality is considered important to positive coworker relationships,[46, 50] suggesting that such conversations among restaurant employees are indeed positive. Kram and Isabella[50] argue that without a difference in hierarchical status, peer coworkers communicate with more mutuality. This may explain why employees in our study had fewer mutual conversations with managers than with other employees.

Regarding conversations with managers, it is not surprising that all respondents reported having had conversations with managers in person at work because prior research indicates that employees prefer to share personal or sensitive information with superiors face-to-face.[51–53] However, a sizeable minority of respondents reported virtual conversations with managers about MHW, which challenges this face-to-face preference and merits further investigation. Mackenzie's[53] research on manager communication and workplace trust similarly indicates a need for future research on virtual communication related to personal information and relationship building: when employees were asked how they maintained relationships at work, a significant number reported doing so via email and telephone. Our findings also suggest that restaurant employees are less likely to spend time with their managers outside of work, and if they do, they do not discuss MHW. In preparing this study, we found no research on how and why employees spend time with their managers outside of work. Mutuality is an element that distinguishes conversations with coworkers from conversations with managers. We can infer that restaurant managers are willing to discuss MHW with their employees since over half of conversations with managers were mutual. However, our results indicate that managers are less likely to start these conversations without employees expressing interest in some way. In comparison with the high rate of mutually initiated coworker conversations, the findings indicate that there is a greater sense of collective understanding among coworkers than between employees and their managers in relation to MHW.

5.4. Motives
Prior research on interpersonal motives for communicating with coworkers implicates affection and relaxation.[63, 64] Similarly, our results indicate that affection is a frequent motivator for restaurant employees discussing MHW with their coworkers. With the similarities between the concept of social support and the affection motive, we can infer that restaurant coworkers are sources of social support in these conversations.[58, 61] Contrary to research on ICM at work, inclusion was also a frequent motivator for restaurant employees in our study. Interestingly, Graham, Barbato and Perse[64] claim that "people are significantly less likely to turn to less intimate relationships, such as strangers, formal friends, and co-workers, to satisfy affection, inclusion, pleasure, and relaxation needs." When discussing the specific topic of MHW, the results of this study show otherwise, with evidence pointing to all four motives. This may be because of the intimate nature of the topic, or because restaurant employees specifically consider their coworkers to be more intimate relationships. In fact, Barbato, Graham and Perse[62] contend that affection, inclusion, pleasure and relaxation are relationally-oriented motives that facilitate positive interactions with others. Thus, we can infer that restaurant employees likely intended to develop or maintain relationships with their coworkers by discussing MHW and that such conversations are positive. These relationally-oriented motives may have been stronger during the pandemic when many people experienced diminished opportunities for relationship building due to social distancing measures. Whether the frequency of these motives was affected by the pandemic or not the results indicate social exchange between restaurant coworkers, which is corroborated by their mutual initiation of conversations. Statements such as, "it makes me feel less lonely" and "I need someone to talk to," are self-oriented in that they imply receiving a resource from other employees, like their company or the opportunity to blow off steam. Statements like, "to show others encouragement" and "to let others know I care about their feelings," are other-oriented because they denote providing a resource to other employees, like emotional support or positive appraisal.[46]

Notably, our comparative analysis of motives reveals that employees were motivated more frequently by these relationally-oriented motives (*i.e.*, affection, inclusion, pleasure, relaxation) when discussing MHW with their coworkers than with their managers. From this we can infer that restaurant employees' relationships with their coworkers are more intimate in nature than with their managers, and that these employees are more often motivated by relationship development and maintenance when discussing MHW with coworkers. Even so, the findings reveal that affection and inclusion are also motivators in conversations with managers. Anderson and Martin's[63] claim that employees are motivated by inclusion and affection when conversing with superiors holds true for a more intimate topic, like MHW. Considering the similarities between the concept of social support and the affection motive, we can infer that restaurant managers are a source of social support for employees in these conversations, although less so in comparison to coworkers.[58, 61] There is evidence to support social exchange between employees and managers, via self-oriented statements, such as "it makes me feel less lonely" and "I need someone to talk to," as well as other-oriented statements, such as "to help" and "to let others know I care about their feelings." We can infer that restaurant employees both solicit resources from their managers and offer them as well, challenging organizational communication scholarship that has more narrowly focused on the one-way support superiors offer subordinates.[42, 43] Our study, along with those cited, demonstrate that the conversational partner and topic of a conversation influence an individual's motives for conversing, a phenomenon deserving of further investigation.

CONCLUSIONS

To the best of our knowledge, this is the first study to examine *communication* about MHW in the restaurant industry; we found no pre-pandemic research with which to compare our findings. After determining whether restaurant employees discussed MHW with their coworkers or managers, we asked why respondents may not engage in such discussions. The consideration of norms, concerns regarding relationship development, and mental health stigma are all implicated in restaurant employees' decisions to not discuss MHW. For those who did have such conversations, we probed the MHW-related topics they discussed, when and how they engaged in conversations, and their motives for communicating. Conversations with coworkers about MHW occur at work, outside of the workplace and virtually. These conversations are mutual and cover a wide variety of MHW-related topics, both work and non-work related. They are also relationally-oriented and positive. During these conversations, coworkers are sources of social support for restaurant employees, and resources are exchanged among coworkers. Conversations with managers about MHW occur predominantly in person and at work during work hours, with a small portion occurring virtually. These conversations are mostly mutual, but not always. When they aren't mutual, restaurant employees are more likely to initiate than their managers. COVID-specific concerns and work stress are dominant topics between restaurant employees and their managers. Although these conversations are relationally-oriented and positive, they are less so in comparison to coworker conversations. Finally, during these conversations, managers are sources of social support for restaurant employees, and resources are exchanged between employees and managers. Through a comparative analysis of employees' discussions with coworkers and with managers, we found important similarities and differences which carry implications for future research and managerial practice.

Research contributions

This study contributes novel information to the body of research on mental health communication in the workplace during a pandemic by investigating employee conversations in some detail and by examining such conversations in restaurant workplaces. Prior research on the disclosure of mental health in the workplace has predominantly approached mental health narrowly, as 'illnesses' and 'disorders,' and investigated reasons for disclosure in medicalized language, for example, after an employee has been clinically diagnosed with depression. This study challenges such approaches by utilizing a more holistic and non-medicalized understanding of MHW and revealing details about conversations previously undiscovered, such as in-person and virtual channels employed, the timing of conversations during or outside of work, and mutuality in the initiation of conversations. This study also extends organizational communication research on S/S and coworker communication by demonstrating the merit in directly comparing coworker and S/S conversations to reveal similarities and differences in not only their communication practices, but also in the nature of their relationships. One interesting finding is that social support and resources are exchanged during conversations about MHW, indicating that closer examination of how these conversations function as support, what specifically is said in these exchanges, and their impact on an individual's mental health and well-being are worthy areas of interpersonal communication research, especially because enacted support is not often studied in the context of workplace relationships. Finally, this study confirms that the ICM concept is feasible and useful not only in an organizational context, but also for investigating interpersonal conversations regarding specific topics.

Managerial implications

The findings reported in this study are important for restaurant managers because they evidence why and how employees discuss MHW with their coworkers and managers, as well as concerns they carry regarding these conversations. The following section details how managers can inform and reconsider their conversations with employees regarding MHW. Firstly, this study suggests that conversations with employees can be harnessed to provide support, expanding opportunities beyond providing mental health days, hanging motivational posters around the workplace, or sending emails with links to mental health resources. Manager relationships and conversations with employees provide an ideal opportunity to show that managers care about their employees' feelings, that they are willing to offer help based on employees' needs, and that they will listen to employees' express their thoughts, opinions, and experiences with MHW. Informed by the results of this study, managers should be encouraged to start formal or informal discussions with employees about topics like burnout, stress, or negative affect related to the workplace and their personal lives. As long as the COVID-19 pandemic continues to impact the restaurant industry, conversations about COVID-specific concerns should continue to be a significant topic of discussion. There are, however, two important caveats that managers must keep in mind. First, they must ensure that conversations about MHW are reciprocal, with opportunities for listening and sharing among all parties. The findings from this study suggest that employees discuss MHW to support and build relationships with their managers, and so, managers who are receptive to such discussions may find it mutually beneficial because past studies have linked positive interactions at work with positive affect. The second caveat is that conversations with managers about MHW ought to be voluntary and optional. Managers should consider how they can make these conversations more comfortable and guarantee that there would be no negative repercussions for any information or feelings shared. First gauging interest in discussion on the side of employees may be the best course of action. Our findings demonstrate that employees may prefer to discuss personal and sensitive topics, like MHW, with only their coworkers or with no one at work at all. Thus,

managers must be mindful to respect their employees' preferences around personal boundaries and recognize that conversations among coworkers are beneficial to coworker relationships too and should not be discouraged.

Limitations and future research

There are several limitations to our study. First, while the findings do provide important insights, they are not generalizable to all restaurant employees due to the small size of the study group, convenience sampling, and the fact that working conditions in general and in the restaurant industry in the locale of this study in particular changed frequently during the COVID-19 pandemic. The use of interviews alongside a survey would have generated richer findings. There was the potential of self-selection bias in this study, in that, respondents who chose to participate were informed on the survey topic by the recruitment material. Thus, respondents who participated were more likely to have had experiences discussing MHW with other work members. Another limitation was the challenge of cultural relevance. The survey was only offered in English, so non-English speakers were less likely to participate. Additionally, the topics related to MHW in the survey were shaped by information from the WHO and CDC, thus, the concepts may not be culturally relevant for different communities with diverse upbringings or backgrounds. Inferential statistical analysis could have complemented the descriptive statistical analysis we conducted. The time constraints of an undergraduate research thesis and more limited knowledge base of the primary student researcher regarding advanced statistical methods led to descriptive analysis as the most feasible course of action. In light of these limitations, future studies should probe culturally-relevant and community-specific MHW concepts, recruit more diverse participants, and include qualitative data, and more advanced statistical analysis.

The results of our study prompt further questions regarding MHW-related conversations in the workplace. Future research should directly examine the relationship between discussing MHW with other workplace members and personal (*e.g.*, mental health, life satisfaction, affect) and organizational outcomes (*e.g.*, collaboration, creativity, productivity). Since this study found multiple reasons why restaurant employees do not discuss MHW with others, there is a clear need for more research probing mental health stigma specifically in the restaurant industry, but also generally in the workplace environment. Specifically, organizational communication scholars may be interested in how workplace culture, for example norms and values, influence conversations about MHW. Additionally, the results demonstrate the use of virtual communication channels to discuss MHW, and that restaurant employees discuss MHW with their managers to support them. Future research should examine in more detail these virtual channels, as well as employees' perspectives on instances of superiors sharing personal information related to MHW. Lastly, a qualitative approach to answering our study's questions, for example using interview or focus group data collection methods, would add nuance and more detailed and contextual information to our descriptive statistical analysis. **Table 6** presents questions that future researchers may consider investigating.

Questions for Future Research
• What is the role of mental health stigma in the restaurant workplace?
• How does workplace culture (*e.g.*, norms and values) influence employees' conversations about MHW?
• Is there a direct relationship between employees' conversations about MHW and their personal and organizational outcomes? What is the nature of this relationship?
• How, why, and through which channels do employees discuss MHW with their coworkers and managers virtually?
• What do employees think about superiors' disclosure of information related to MHW?
• How do employees describe conversations about MHW with coworkers and managers in interviews and focus groups?

Table 6. Questions for future research.

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PRESS SUMMARY

Restaurant employees in the United States have experienced unprecedented challenges to their mental health and well-being (MHW) during the COVID-19 pandemic, yet little is known about communication regarding MHW in the restaurant industry. This study probed whether, how, and why or why not restaurant employees in western Washington State discussed MHW with one another and their managers during the winter of 2021. Key findings include that there are many reasons why some restaurant employees do not engage in conversations about MHW with other members of the workplace. However, when such conversations do occur, they are typically mutual, positive, and relationally-oriented—more so among coworkers than between employees and managers. Comparative analysis of conversations with coworkers versus managers revealed both similarities and differences that carry implications for managerial practice and future research.

Differential Expression of Hub Genes and Activation of p53 by Anti-cancer Compound Curaxin CBL0137

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ABSTRACT

Cancer is a global concern, and there is a need for effective drugs. CBL0137 is a small water-soluble molecule and a new second-generation compound in the family of curaxins with potential anti-cancer activity. Curaxins in general, including CBL0137, intercalate into DNA, act by targeting the histone chaperone 'facilitates chromatin transcription' (FACT) complex, and have the potential to treat tumors by reducing the growth of cancer cells which is shown in a variety of cell lines and animal models. CBL0137 is found to activate the tumor suppressor gene p53. However, the mechanism of p53 activation is poorly understood. Utilizing bioinformatics analysis on available datasets of CBL0137 treated cancer cells of glioma, cervical and multiple myeloma, differentially expressed genes (DEGs) that may lead to the activation of p53 were examined. Three GEO datasets of cells treated with various concentrations of CBL0137 were analyzed, namely HSJD-DIPG007 (GSE153441), MM1.S (GSE117611), and HeLa S3 (GSE117611). The DEGs were identified based on p-values less than 0.05, logFC values greater than 1 and less than -1 and analyzed using GEO2R, Enrichr, and STRING, and data visualization was performed on Tableau. Compared to the controls, a total of 229, 1425, and 1005 genes were upregulated while 368, 2322, and 1673 genes were downregulated for HSJD-DIPG007, MM1.S, and HeLa S3 datasets, respectively. Further collective analysis revealed a total of 38 common DEGs among the three datasets. Using Enrichr and STRING on these 38 DEGs, seven hub genes were obtained, SKP2, RGS16, CSRP2, CENPA, HJURP, DTL, and HEXIM1 with these possible mechanisms: inhibition of AKT phosphorylation by upregulated genes RGS16 and CSRP2, p300-mediated acetylation of p53 via SKP2, inhibition of MDM2 by DTL downregulation and HEXIM1 upregulation, and inhibition of AURKB via CENPA and HJURP downregulation. This study analyzed the three datasets and highlighted how these identified hub genes might play a role in leading to p53 activation by CBL0137.

KEYWORDS

Curaxin; CBL0137; Differentially Expressed Genes; Cancer; p53; Glioblastoma; Cervical; Myeloma

INTRODUCTION

In 2022, it is estimated that there will be 1.9 million new cancer cases with 609,360 cancer-related deaths in the United States alone.[1] There are a plethora of intolerable side effects of chemotherapy, and additionally, the clinical efficacy of chemotherapy can be compromised due to the possibility of drug resistance during treatment. New agents are being discovered or synthesized and investigated for this reason. Through research and experimentation, the anti-malarial compounds known as curaxins were developed in their second-generation group, of which the member CBL0137 has been deemed an agent with anticancer activity and examined Phase I/II trial.[2] According to literary findings, curaxin has displayed antitumor activity in glioblastoma, renal cell carcinoma, melanoma, neuroblastoma, and small cell lung cancer.[3]

CBL0137 exerts tumor suppression activity in part by activating the tumor suppressor gene p53.[3-5] However, the mechanisms through which this occurs are not completely understood. Systematically, CBL0137 is identified to act via the inhibition of the facilitating chromatin transcription (FACT) complex which is composed of two subunits, SPT16 and SSRP1, and is responsible for the disassembly and reassembly of nucleosomes mandatory for transcription, DNA replication, and repair.[3-5] SSRP1 affects p53 activity via association with the kinase CK2, leading to activation of p53 and inhibition of NF-kB.[3] It is not known if CBL0137 affects other well-known mechanisms that activate p53, such as AKT phosphorylation, p-300 mediated acetylation signaling pathway, p53/MDM2 pathway, and AURKB inhibition.[6-9] The objective of this research study is to analyze CBL0137's effects on gene expression leading to p53 activation in cancer cells by using expression profile datasets of treated and untreated glioma cells, and cervical and multiple myeloma cell lines.

METHODS AND PROCEDURES

GEO Datasets

Pubmed was used as a biomedical/life science search engine and database to conduct research on Curaxin CBL0137, the divergent pathways through which it may function, and the various genes that play a significant role in the mechanisms. GEO DataSets (https://www.ncbi.nlm.nih.gov/gds) was used to find datasets with CBL0137 treatment. The expression profiling by array from three cell types: HSJD-DIPG007 diffuse intrinsic pontine glioma cells (GSE153441), HeLa S3 cervical cancer cell line (GSE117611), and MM1.S multiple myeloma cell line (GSE117611) that consisted of untreated or treated with concentrations of 0.6 µM, 3 µM, and 3 µM of CBL0137, respectively, were used. GSE153441 was provided by Wilkins Lab from The University of New South Wales. They treated HSJD-DIPG007 cells with a single concentration of 0.6 µM of CBL0137. GSE117611 was provided by the Cell Stress Biology Department at Roswell Park Cancer Institute. They treated the MM1.S cell line with 0, 0.3, 1, and 3 µM of CBL0137. They also treated the HeLa cell line with 0 and 3 µM of CBL0137. In this study, we selected the highest CBL0137 concentration available from each dataset because these concentrations were optimal for inhibiting cancer cell growth in their initial studies.[10,11] GEO2R Analyzer (https://www.ncbi.nlm.nih.gov/geo/geo2r/) was used to compare the control group (no treatment of CBL0137) with test groups (various concentrations of CBL0137) from the same dataset.

Screening Differentially Expressed Genes

Volcano plots were generated with GEO2R Analyzer, Tableau 2020 and *https://paolo.shinyapps.io/ShinyVolcanoPlot/*, for reproducibility and confirmation. We identified genes with -log(p-value) greater than 1.3 and logFC greater than 1 or less than -1. For the volcano plot, all 20,000 to 50,000 genes from all three datasets - obtained from GEO2R Analyzer - were used to identify differentially expressed genes (DEGs). We further determined the common genes between three different datasets and created heat maps to visually identify the differences in fold change across all three datasets.

Enrichment Analysis

We used Enrichr (https://maayanlab.cloud/Enrichr/), an enrichment analysis web-based tool that checks whether an input set of genes significantly overlaps with the annotated gene sets from the database. Enrichr contains 35 set libraries separated into six categories: transcription, pathways, ontologies, diseases/drugs, cell types, and miscellaneous. Once all of the total upregulated and downregulated DEGs were narrowed down to 38 commonly expressed DEGs between the three datasets, the 38 genes were input to Enrichr to compare them against numerous genes of known biological function. In observing the top five pathways of upregulated DEGs and downregulated DEGs in BioPlanet, GO Cellular Component, and KEGG Human, we were able to further analyze specific genes and their biological relevance upon CBL0137 treatment in cancerous cells.

Protein-protein Interaction Networks

STRING (http://www.string-db.org/) is a biological database and online web resource tool of known and predicted direct and indirect protein-protein interactions (PPI's) in numerous, varying organisms. STRING was used to visualize the PPIs between the final list of the 38 statistically significant differentially expressed genes common to all three datasets and the 4 significant differentially expressed genes found via literature evidence that were observed to be common to only two of the three datasets, using Homo sapiens as the model organism. To start off, we input a custom value of 0.5 confidence - the probability of an association between two proteins existing within the same Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway - for the interaction score. This value met the needs of our study as it was in the range of medium confidence (0.4) to high confidence (0.9), highlighting significant protein-protein interactions and producing utilizable data. Each individual PPI is scored on a scale of 0 to 1. This value is known as the combined score; it does not represent the strength or specificity of the association, but rather how likely it is that the interaction is accurate, based on genomic context predictions, high through-put laboratory experiments, conserved co-expressions, automated text mining, and previous knowledge in databases (http://www.string-db.org/).

RESULTS

Identification of 38 Common Differentially Expressed Genes from Three Datasets

Three different datasets representing three cancers and effects by CBL0137 were evaluated. Genes with -log(p-value) greater than 1.3 (means p < 0.05) and logFC greater than 1 or less than -1 from HSJD-DIPG007, HeLa S3, and MM1.S datasets were identified as differentially expressed genes (DEGs) from the excel sheet obtained from GEO2R and visualized from the volcano plots. GEO2R's default setting of Benjamini & Hochberg false discovery rate method was applied to the p-values. DEGs are represented by red dots in **Figure 1**. We first identified the total differentially expressed genes in each dataset and then genes common to all three datasets and any two of the datasets, as shown in **Figure 2**. There were 597, 3747, 2678, DEGs for HSJD-DIPG007-CBL0137, MM1.S-CBL0137, and HeLa S3-CBL0137, respectively. Of these, there were 229, 1425, 1005 upregulated genes and 368, 2322, 1673 downregulated genes for HSJD-DIPG007-CBL0137, MM1.S-CBL0137, and HeLa S3-CBL0137, respectively. Downregulated genes are marked in red in the upper-left corner of each graph, whereas upregulated genes are marked in red in the upper-right corner of the graph. It is of interest to note that there were more downregulated genes in all three datasets. Examining the common DEGs in all three cancer datasets, 38 genes were common to all datasets, 51 genes

common to HSJD-DIPG007 and HeLa S3, 73 genes common to HSJD-DIPG007 and MM1.S, and 954 genes common to HeLa S3 and MM1. After analyzing all three datasets together, it is of interest to note that 38 genes out of a total of 65,537 genes were identified as common DEGs.
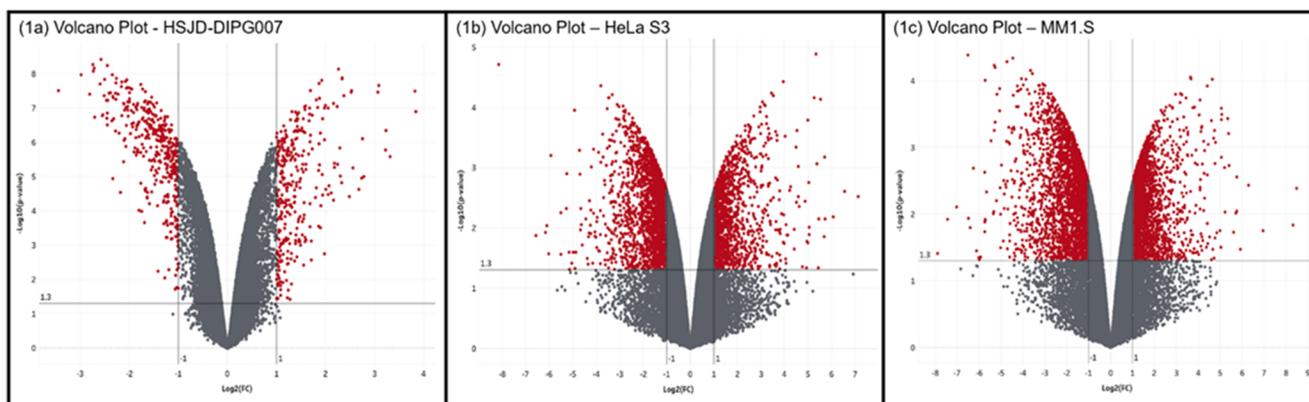

Figure 1. Volcano Plots obtained from comparing test samples to their own untreated control; (a) HSJD-DIPG007 glioma cells dataset, (b) HeLa S3 cervical cancer cell line dataset, and (c) MM1.S multiple myeloma cell line dataset. Upregulated genes are in the upper-right section of the graph and represent logFC > 1 and p-value < 0.05. Downregulated genes are in the upper-left section of the graph and represent logFC < -1 and p-value < 0.05.
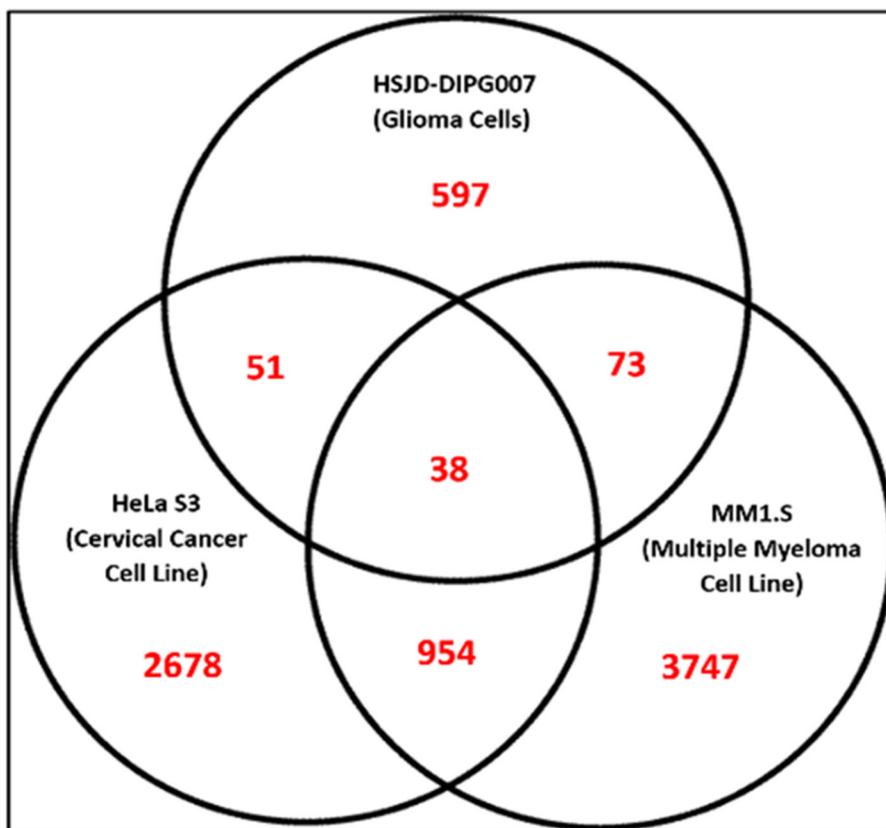

Figure 2. Venn Diagram showing total DEGs in each of the three datasets and overlapping DEGs in two or three of the datasets.

Collation of Datasets Using Heat Map

A heat map was created comparing all three datasets: HSJD-DIPG007 (0.6 μM CBL0137), HeLa S3 (3 μM CBL0137), and MM1.S (3 μM CBL0137). **Figure 3** depicts the 38 common genes in rows, 3 different datasets in columns and color gradient representing logFC of the gene after the treatment of CBL0137 when compared to the control. The majority of the common genes were downregulated in the HSJD-DIPG007, HeLa S3, and MM1.S. On the other hand, AURKA, EPM2AIP1, FAM83D, IFIT2, NBEA, and PRR11 were differentially expressed in different directions in at least one of the datasets.
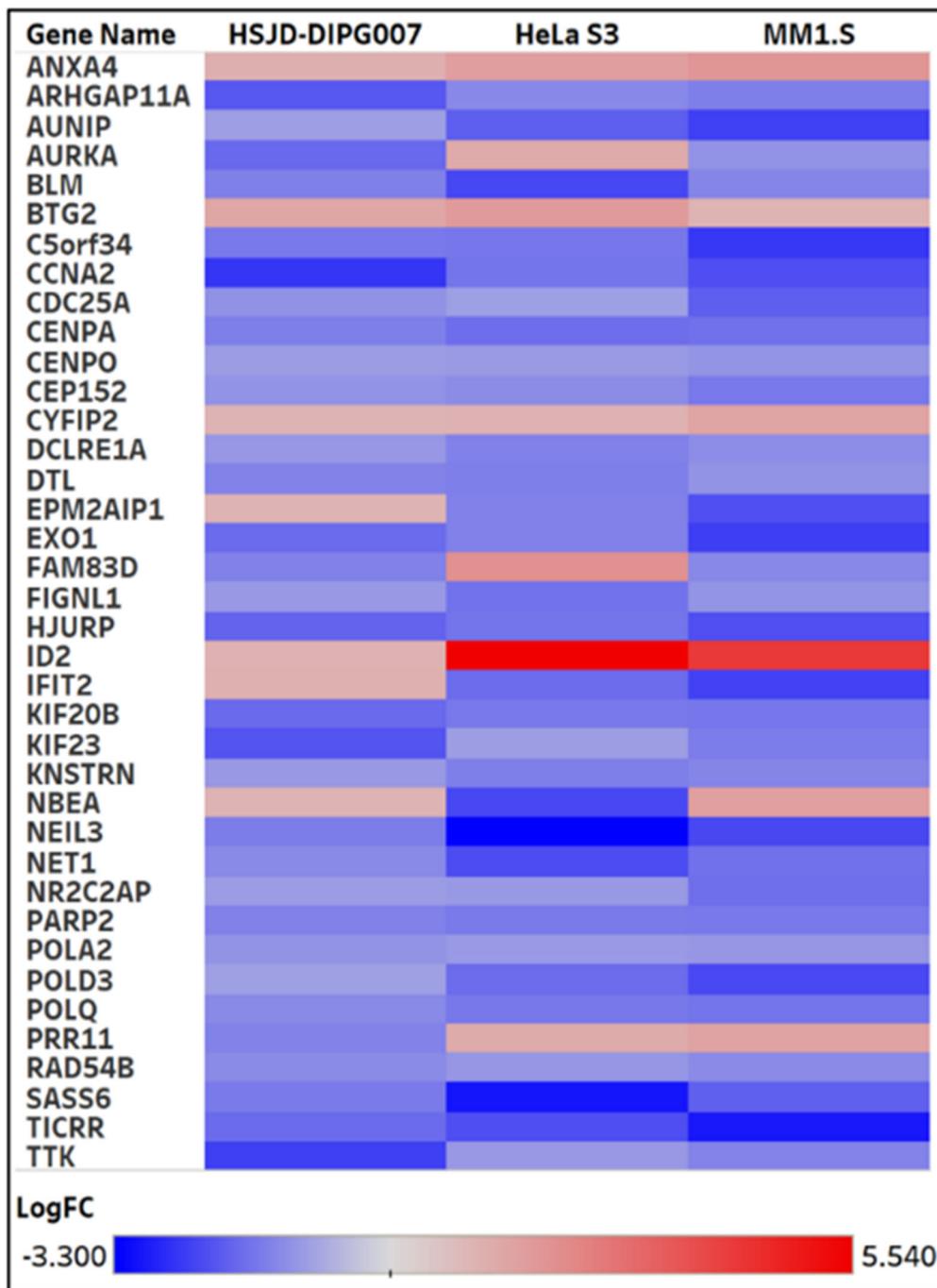
Figure 3. Heat map of the 38 common genes, between three datasets, treated with CBL0137. Red represents upregulated genes, and blue represents downregulated genes. All DEG's have a p-value of less than 0.05.

Relevant Pathways of Upregulated and Downregulated DEGs

Enrichr was used to determine the most relevant five pathways of upregulated DEGs and downregulated DEGs in BioPlanet, GO Cellular Component, and KEGG Human given the 38 common DEGs, as shown in **Figure 4**. In the Enrichr analysis the colored bar graphs represent the significant p-values, and the asterisk next to the p-value corresponds to it having a significant adjusted p-value which was calculated based on the Benjamini-Hochberg method. BioPlanet 2019 showed that most of the 38 common genes are part of the cell cycle, chromosome maintenance, DNA replication, homologous recombination, and base excision repair pathways. The top five pathways in GO Cellular Component 2021 of the 38 common genes are intracellular non-membrane-bounded organelle, spindle, deuterostome, nucleus, and microtubule cytoskeleton. KEGG Human 2019 showed that

most of the 38 common genes are part of the base excision repair pathways, homologous recombination, mismatch repair, progesterone-mediated oocyte maturation and cell cycle.
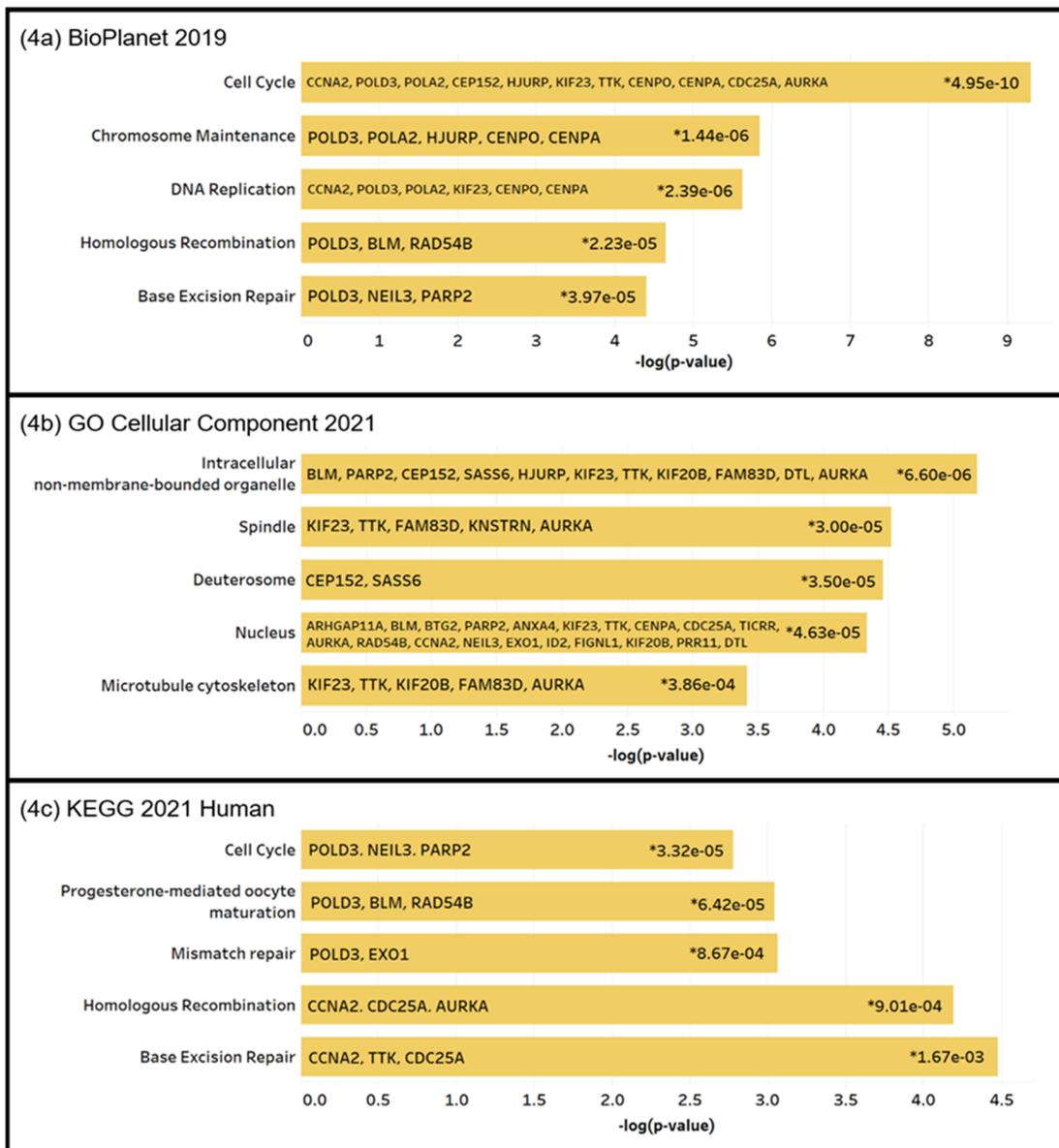

Figure 4. Top five pathways of 38 common DEGs from three datasets in (a) BioPlanet 2019, (b) GO Cellular Component 2021 and (c) KEGG 2021 Human. P-values are shown with *. Corresponding genes of each pathway are listed within the bars of the graphs.

Identification of Hub Genes

STRING, a database of known and conjectured direct and indirect protein-protein interactions, was utilized to depict the protein associations between the 38 common genes, selected upregulated and downregulated genes that were found in only two datasets (RGS16, CSRP2, HEXIM1, and SKP2), and the genes that are already known to act as regulators for the potential candidates: TP53, NFKB1, AKT1, EP300, MDM2, and AURKB. The STRING plot with an interaction score of 0.5, as shown in **Figure 5**, was chosen to be the main focal point as it illustrated all the possible protein-protein interactions that were statistically significant. Certain hub genes were then picked from the STRING plot that were found to have significant effects on p53. The likelihood of the interactions - between certain genes and p53 - to be deemed true was based on the combination score values listed in **Table 1**. Subsequently, all of the 954 differentially expressed genes that were common to the HeLa S3 and MM1.S datasets, such as RGS16 and CSRP2 among 25 genes, were further analyzed on STRING with an interaction score of 0.5 and 0.4 as shown in **Figure 5**. RGS16 and CSRP2 are found to have edges or interaction score of 0.5.

Gene From Dataset	Upregulated or Downregulated	Interaction Score	Interaction with p53 on STRING Plot	Combination Score of Gene with p53 directly	Interaction with a p53 Regulator	Combination Score of Gene with p53 Regulator
RGS16	Upregulated	0.2	Direct and Indirect	0.259	AKT1	0.324
CSRP2	Upregulated	0.2	Direct	0.22	N/A	N/A
CENPA	Downregulated	0.5	Indirect	N/A	AURKB	0.998
HJURP	Downregulated	0.5	Indirect	N/A	AURKB	0.919
TTK	Downregulated	0.5	Direct and Indirect	0.765	AURKB	0.98
KIF23	Downregulated	0.5	Direct and Indirect	0.574	AURKB	0.998
SKP2	Downregulated	0.5	Direct and Indirect	0.971	MDM2 / AKT1 / AURKB / EP300	0.579 / 0.792 / 0.745 / 0.960
DTL	Downregulated	0.5	Direct and Indirect	0.624	MDM2 / AURKB	0.556 / 0.856
HEXIM1	Upregulated	0.5	Direct and Indirect	0.501	MDM2 / AKT1	0.689 / 0.550

Table 1. Interactions and combination score of genes from STRING plot.
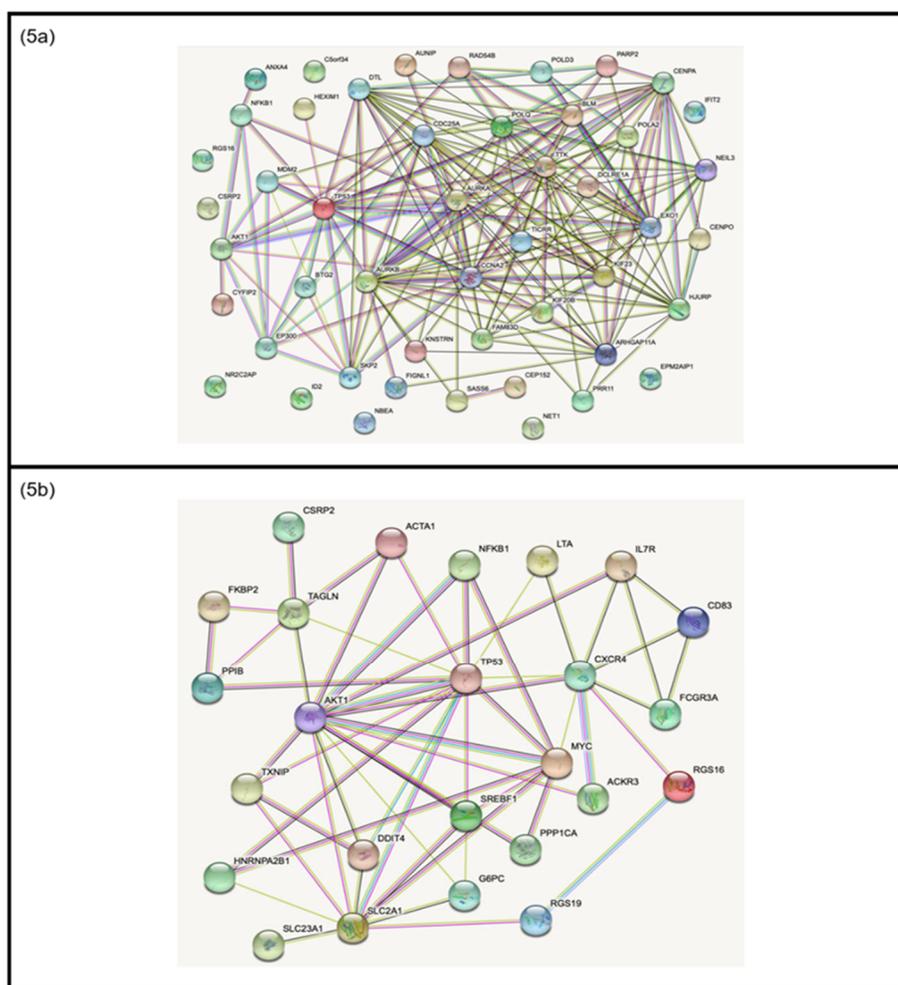

Figure 5. STRING plot depicting protein-protein interactions between the 38 common genes, four selected genes (RGS16, CSRP2, HEXIM1, and SKP2), potential regulators of the tumor suppressor gene (NFKB1, AKT1, EP300, MDM2, and AURKB) and TP53: (a) with an interaction score of 0.5 and (b) with an interaction score of 0.4.

DISCUSSION

Enrichr and String Analysis

This study identified seven potential hub genes – SKP2, RGS16, CSRP2, CENPA, HJURP, HEXIM1, and DTL – that indirectly cause p53 activation and result in tumor suppression, as shown in **Table 2** and **Figure 6**. The BioPlanet 2019 analysis conducted on Enrichr revealed that CENPA and HJURP are part of the cell cycle and chromosome maintenance pathways. Furthermore, it

was found that CENPA is also involved in the DNA replication pathway. GO Cellular Component 2021 showed that HJURP is part of an intracellular non-membrane bound organelle whereas CENPA and DTL are part of the nucleus. STRING plot, created with an interaction score of 0.5, identified five hub genes – SKP2, CENPA, HJURP, DTL, and HEXIM1 – which exhibited the truest protein-protein interactions. Potential associations between p53/RGS16 and p53/CSRP2 were recognized, as seen on the STRING plot with an interaction score of 0.4 and 0.2, and in **Table 1**. The absence of connections involving these two hub genes on the STRING plot with an interaction score of 0.5 are due to the confidence scores which are based on literature evidence. According to several literature sources on breast, colorectal, and pancreatic cancer, it is evident that the genes RGS16, CSRP2, HEXIM1, and SKP2 - while only common to two of the three datasets - are all significant in relation to the activity of the p53 either through a direct relationship or indirectly through its regulators, and therefore are reported in this study.[7,12,14,17]

Genes From Combined Datasets	Combined Datasets	LogFC	Up- or Downregulated Gene	p53 Regulator	p53
SKP2	Glioma	-1.28	Downregulated	p300 binding to SKP2 inhibited	Activation
	HeLa S3	-1.13			
		-1.24			
		-1.78			
RGS16	Hela S3	3.68	Upregulated	AKT phosphorylation inhibited	
	MM1	2.29			
CSRP2	Hela S3	3.52	Upregulated	AKT phosphorylation inhibited	
	MM1	1.73			
CENPA	Glioma	-1.51	Downregulated	AURKB decreases	
	Hela S3	-1.78			
	MM1	-1.73			
HJURP	Glioma	-1.93	Downregulated	AURKB decreases	
	Hela S3	-1.67			
	MM1	-2.22			
DTL	Glioma	-1.46	Downregulated	MDM2 decreases	
	Hela S3	-1.5			
	MM1	-1.19			
HEXIM1	Hela S3	3.17	Upregulated	HDM2 decreases	
	MM1	2.12			

Table 2. Expression of seven hub genes by CBL0137 from the datasets combined and their interaction with regulators that may activate p53.
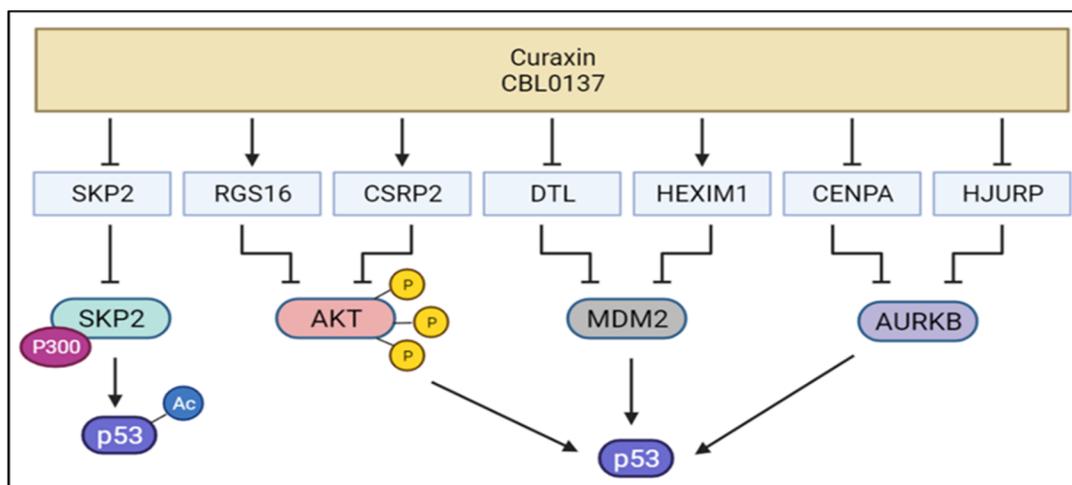

Figure 6. Seven hub genes that may be targeted by CBL0137 and their potential pathways leading to p53 activation.

Inhibition of AKT Phosphorylation by Upregulated Genes RGS16 and CSRP2
RGS16 was found to be upregulated with a logFC of 3.68 and 2.29 in HeLa S3 and MM1.S cell lines, respectively. It has been reported that RGS16 plays a significant role in inhibiting pancreatic cell and breast cancer cell growth.[12,13] Our experimental findings confirm the upregulation of RGS16 by CBL0137 in a cervical cancer cell line, HeLa S3. CSRP2 is another upregulated gene, with a logFC of 3.52 and 1.73 in HeLa S3 and MM1.S cell lines, respectively. Prior studies have shown that CSRP2

promotion is known to suppress colorectal cancer and inhibition of CSRP2 is known to proliferate leukemia cells.[14,15] This study identified and confirmed that both RGS16 and CSRP2 are genes upstream of the AKT signaling pathway and inhibit AKT phosphorylation, resulting in the stabilization of p53.

p53 Acetylation and its Stabilization Via SKP2
SKP2 is a downregulated gene in the glioma and HeLa S3 dataset, with logFC values of -1.28 and -1.24, respectively. CBL0137 inhibits p300 from binding to SKP2, making p300 available to acetylate p53. Acetylation of p53 leads to death of cancer cells. Literature evidence shows that SKP2-mediated inhibition of p300 is known to decrease p53 in breast cancer cells.[7]

Inhibition of HDM2 / MDM2 by DTL Downregulation and HEXIM1 Upregulation
DTL, also known as L2DTL, is a downregulated gene found in the HSJD-DIPG007 cells, MM1.S cell line, and HeLa S3 cell line with logFC values of -1.46, -1.19, and -1.5, respectively. According to scientific literature, DTL has a positive relationship with MDM2; the downregulation of DTL inhibits the proto-oncogene MDM2.[16] Our study confirms the downregulation of DTL by CBL0137, which leads to the regulation of p53 polyubiquitination and induction of p53 expression. HEXIM1 is an upregulated gene found in the HeLa S3 cell line and MM1.S cell line with logFC values of 3.17 and 2.12, respectively. HDM2, a human homolog of MDM2, is known to bind with p53 causing p53 degradation. The binding of HEXIM1 with HDM2 prevents HDM2 from binding with p53 leading to inhibition of p53 ubiquitination.[17]

Inhibition of AURKB by Downregulation of CENPA and HJURP
CENPA is a downregulated gene found in the CBL0137 treated groups of HSJD-DIPG007 cells, MM1.S cell line, and HeLa S3 cell line, with logFC values of -1.51, -1.73, and -1.78, respectively. Scientific research and literary findings have reported that the downregulation of CENPA has significant effects in inhibiting cancer cell growth. It is able to decrease the expression of proto-oncogene AURKB since Aurora B kinase targets CENPA which in turn would result in p53 activation.[9, 18-20] Our experimental findings and statistics confirm the downregulation of CENPA by CBL0137 in all three cell lines analyzed. HJURP is another downregulated gene found in HSJD-DIPG007, MM1.S, and HeLa S3 cell lines. HJURP presented logFC values of -1.93 in Glioma, -2.22 in MM1.S, and -1.67 in HeLa S3. The inhibition of HJURP results in the knockdown of AURKB hence, demonstrating a positive relationship between both genes.[18] Indeed, there is a negative correlation between HJURP and p53 as the inhibition of AURKB leads to senescence by p53 expressing its tumor-suppressing activity.[21] Our study reveals that CENPA and HJURP are both genes upstream of the AURKB pathway, by the effects of CBL0137, and thus lead to p53 activation.

Current Limitations and Future Work
It should be noted that in this study only three cancer cell types were examined. Also, since we were comparing three extremely diverse cancers that are a product of various specific mutations, the response to the treatment with the same anti-cancer drug differed and made some cells more or less insensitive. The datasets used concentrations of CBL0137 appropriate to IC_{50} in the cell type. Further studies include supporting this bioinformatics research with experimental data which can confirm the role of our identified hub genes and proteins leading to p53 activation. In addition, treatment of other cancer cell lines with CBL0137 and examination of elements from pathways described may provide validation. This study highlighted certain critical pathways through which p53 can be activated. One of the most promising genes that should be studied further is CSRP2. Based on our survey of literature of these identified hub genes, CSRP2 and its mechanism of action leading to p53 activation was found to be the least studied. Our findings suggest that the upregulation of CSRP2 can lead to the inhibition of AKT phosphorylation and the detailed mechanisms should be explored further through in vitro studies with MM1.S, HeLa S3, and glioma cells aimed at examining the phosphorylation changes.

CONCLUSIONS
CBL0137 holds promise against various cancers. Using three different datasets, we identified the common differentially expressed genes and selected seven hub genes - RGS16, CSRP2, SKP2, DTL, HEXIM1, CENPA, and HJURP - which play a significant role in three divergent pathways all leading to, and resulting in, p53 stabilization and activation.

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PRESS SUMMARY

This research analyzed common differentially expressed genes by a curaxin member, CBL0137, a potential anti-tumor compound, in datasets of glioblastoma, cervical cancer, and multiple myeloma for potential pathways leading to the activation of p53. Seven hub genes were identified – SKP2, RGS16, CSRP2, CENPA, HJURP, DTL, and HEXIM1 – which may act *via* inhibition of AKT phosphorylation by upregulated genes RGS16 and CSRP2, p300-mediated acetylation of p53 via SKP2, inhibition of MDM2 by DTL downregulation and HEXIM1 upregulation, and inhibition of AURKB via CENPA and HJURP downregulation. Future validation studies for p53 modulation may focus on these genes.

Cemetery Analysis of Whitewater, WI

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ABSTRACT
Procedures and customs surrounding funerals, burial, and grave marking vary widely by time period, location, culture, and religion, among many other factors. This project investigated the gravestone customs of cemeteries in Southern Wisconsin, USA. Utilizing a dataset of 500 gravestone samples collected from cemeteries in Whitewater, WI, the aim of this project was to objectively measure how people choose to remember their dead and how these practices have evolved over the years. Because of the decline in American religiosity in recent decades, the expectation of this project was to see the usage of religious symbols decline. Based on this analysis, this does not appear to be the case. Practices such as the recording of one's name and year of birth/death have remained constant; however, other customs of remembrance, such as the use of religious symbols and the recording of one's date of marriage, have shifted dramatically over the years, reflecting the evolution of society and culture.

INTRODUCTION
Humans use gravesites as a method of remembering and communicating information about those who have died;[1] accordingly, gravestones can be thought of as the most permanent method of recording and memorializing those who have passed. Gravestones, then, are often used to tell the story of those whose bodies they mark.[2] This occurs through the recording of their name, dates of birth and death, and perhaps their cause of death, occupation, family role, memorable quotes, epitaphs, *etc.*[1, 2] This project aims to identify how residents of Southern Wisconsin have historically and currently remember and honor their dead in cemeteries. The only peer-reviewed analysis of Wisconsin cemeteries the author could find was a 1960 study on the Eden-Scottsbluff complex, which is dated as far back as 6,500 B.C.;[3] accordingly, this study offers an original contribution to academic literature in an area for which there is little to no preexisting academic research.

For many, religion is among the most important and defining aspects of our lives; therefore, religious symbols, scripture quotations, and iconography are also important aspects of how we remember and honor our dead. For decades now, however, there has been a dramatic decline in religiosity amongst Americans;[4, 5] accordingly, in this investigation of Wisconsin cemeteries, there was an expectation of a decline in the use of religious symbols, scripture quotations, and iconography on graves of those who have died more recently. In addition to religious symbols, this project will analyze the presence of temporary decorations, non-religious iconography, the type of gravestone used, and the recording of the deceased occupation, family role, or marital status.

METHODS AND PROCEDURES
The data from this study represent information collected from gravestones at two public cemeteries in Whitewater, WI. Between January 12-13, data was collected from the two primary, largest cemeteries in the city: Hillside Cemetery and Calvary Cemetery. In total, 500 random samples were collected between the two, with 71% (Hillside) and 29% (Calvary) split between them. Hillside Cemetery is the primary and, by far, the largest cemetery in the city; consequently, it represents a significantly greater share of the data.

From each sample, the following information was collected: whether the grave was for an individual (one or two persons) or a family, the year of death, the presence of symbols on the stone, the presence of temporary decorations, and the recording of the deceased's family role, occupation, or date of marriage. The following is a brief explanation of some potentially ambiguous measures. In consideration of married couples, gravestones that were for one or two individuals were deemed "individual graves." Gravestones for three or more individuals, however, were considered "family graves" in this study. Gravestones with symbols on them were further categorized into religious symbols (such as a cross, bible, or angel), non-religious symbols (such as a flower

design, calculator, or baby), or both (for gravestones with multiple symbols, with at least one of each type). "Temporary decorations" refers to the presence of perishable goods which were not permanently imbedded into the gravestone (such as flowers, a wreath, a picture frame, or candles). Finally, "family role" refers to the recording of the deceased's role as a husband, wife, father, mother, brother, sister, *etc.*

RESULTS

Overview

The expectation of this project was to observe a decrease in the presence of religious symbols, quotes, and icons on and around gravesites to match the decrease in American religiosity observed over the last 50+ years; contrary to this expectation, there was a significant increase in the use of both religious and nonreligious symbols on graves. In fact, gravestones have become increasingly more intricate and information-filled across all measured metrics over recent years. The increased intricacy of gravestones can be explained, in large part, by the development of laser engraving tools, making such designs easier and cheaper to implement.[6] As will be discussed throughout this paper, cultural evolution also plays a major role in this development.

The years of death measured in this sample were split into five different categories of varying sizes. 8% of the sample died between 1800-1899, 16% between 1900-1949, 16% between 1950-1974, 34% between 1975-1999, and 26% between 2000-2022. Note that the years represented in each category becomes progressively smaller. The majority of the gravestones recorded marked individuals rather than families (82% of graves) and included symbols of some kind (74% of graves). Meanwhile, only about half of the graves (49%) included religious symbols. Other gravesite features measured, including the presence of temporary decorations, or the deceased family role, date of marriage, and occupation, were significantly less common.
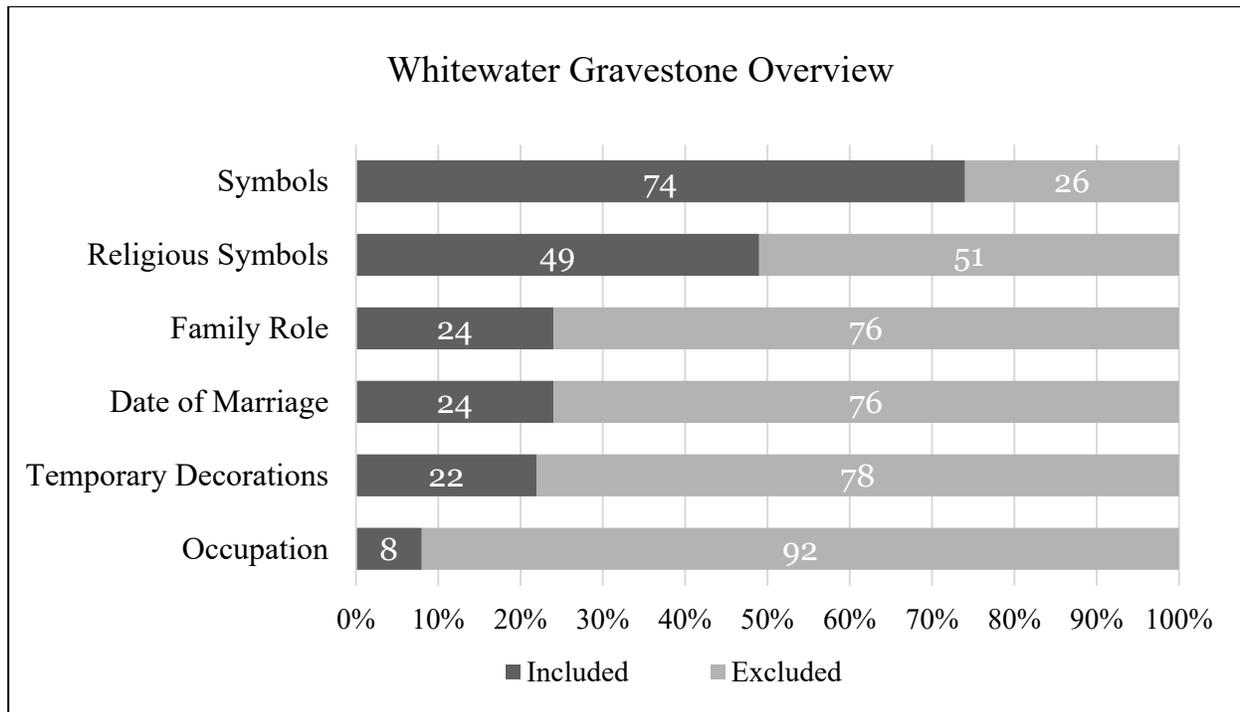

**Figure 1.** Whitewater gravestone overview.

Year of Death Distribution

Period	Percentage
1800 - 1899	8
1900 - 1949	16
1950 - 1974	16
1975 - 1999	34
2000 - 2022	26
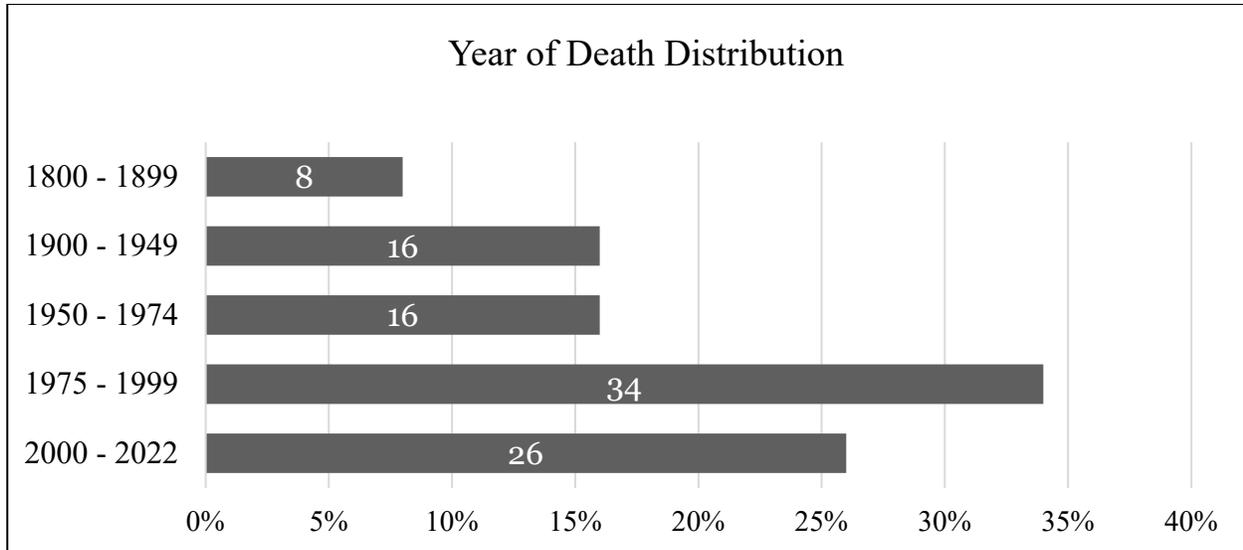
Figure 2. Year of death distribution.

Gravestones, Religion, and Symbology

Period	No Symbols	Both	Religious Only	Non-Religious Only
1800 - 1899	59	8	13	20
1900 - 1949	36	8	45	11
1950 - 1974	44	11	28	17
1975 - 1999	19	19	36	26
2000 - 2022	8	26	29	37

■ No Symbols   ■ Both   ■ Religious Only   ■ Non-Religious Only
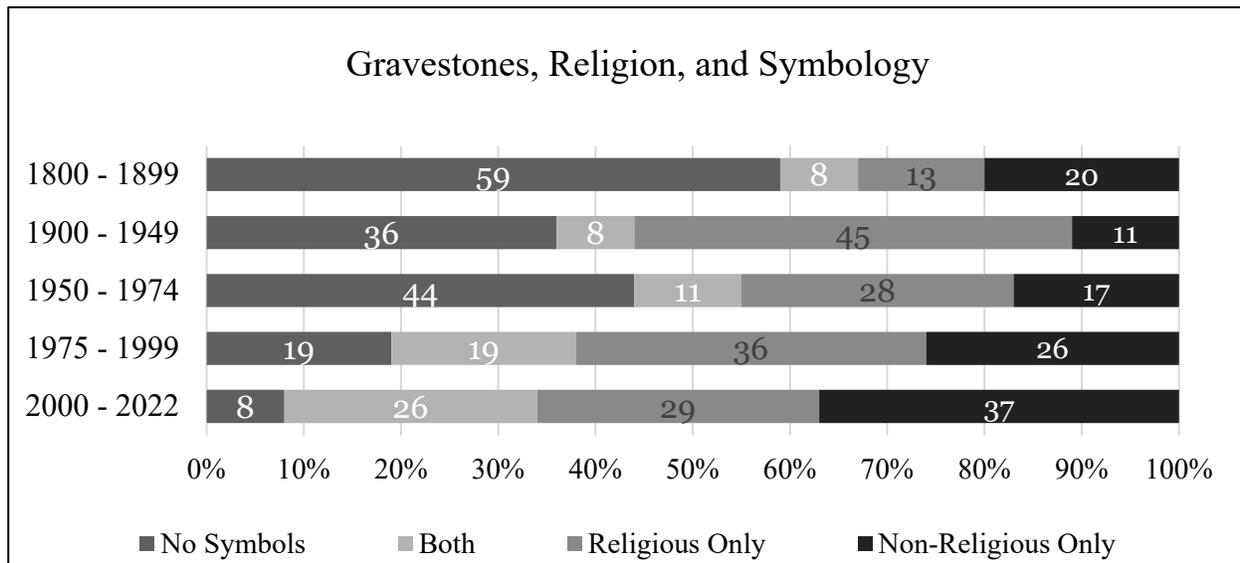
Figure 3. Gravestones, religion, and symbology.

Gravestones, Religion, and Symbology

This study found that the use of symbols on graves has increased substantially over the years. Between 1800-1899, 59% of gravestones sampled had no symbols of any kind on them. By the years 2000-2022, this number had been reduced to just 8%. At 55%, graves marking those who died between 2000-2022 were the most likely to have religious symbols of some kind on them. This is similar to graves marking those who died between 1900-1949, wherein 53% had such symbols. These numbers are significantly different, however, from 19th century graves, as well as graves from between 1950-1974, wherein only 21% and 39% had religious symbols, respectively. Since the mid-20th century – which is where previous research has suggested the significant decline in American religiosity began[4, 5] – the use of religious symbols on graves has actually increased by 16% in this sample. At the same time, however, the use of exclusively non-religious symbols has also increased dramatically, from 20% in the 19th century and 11% between 1900-1940, to 37% by the years 2000-2022. This growth of exclusively non-religious symbol usage has been far more linear than the exclusive use of religious symbols. Since the first half of the 20th century, the use of *exclusively* religious symbols has declined by 16%, which is also the exact percentage the use of exclusively non-religious symbols increased since this time. Religious symbols on Whitewater graves seem to be exclusively Christian, as no other religions were ever represented in this sample.

Non-religious symbols were often simple decoration, such as flowers, garlands, or designs. In many circumstances, however, symbols also seemed to represent something personal and important to the deceased, such as a calculator, stethoscope, Green Bay Packer's helmet, *etc.* Some of these symbols were likely associated with the deceased occupation; nonetheless, these cases were not counted as markers of occupation due to ambiguity. For example, a stethoscope may indicate one was associated with the medical field, however such information is not explicit. Many other symbols represented the deceased's organizational involvement, such as a masonic star or compass, or symbols from a particular sport such as football or soccer. Symbols were the only manner in which people recorded their involvement in clubs, organizations, and sports, as well as their personal hobbies, as this information was never recorded in words. The prevalence of masonic and sporting imagery may suggest that these activities were "defining" to the identity of past Whitewater inhabitants. For them, these interests may have been more important to the Whitewater culture than other interests, such as common occupation or history. The exclusive use of symbols to record such information speaks to the importance of symbolism for self-expression. Finally, some symbols played off information on the deceased stone, such as the word play with the last name "Hare," and the accompanying picture of two hares as seen in Figure 4.

Figure 4. "Hare" gravestone displaying wordplay.

Individual vs. Family Graves

To reiterate, the term "individual" grave, in this study, refers to any gravestone which marks only one or two individuals; simultaneously, the term "family" grave to refer to any gravestone which marks three or more individuals. While it is quite common for couples to be buried together, graves which house more than two individuals seem to be slightly different in function. In researching Whitewater cemeteries, there appeared to be three types of "family" gravestones. The first type of family stone uses one major stone to mark a family's last name **(Figure 6)**, and is accompanied by several small gravestones for each individual **(Figure 7)**, which often record nothing more their name, year of birth, and year of death. The second type of family stone is typically shaped like an obelisk, which allows four different groups or individuals of the family to have their own face of the stone, writing what they'd like on it **(Figures 8 & 9)**. The first type of family stone would have been significantly cheaper than the second due to its simplicity of design and material. As such, economics likely influenced which of these stone-types one chose. The third and final type of family gravestone looks like an individual's grave, except three or more individuals are marked by it **(Figure 10)**. The first and second types of family stones were quite popular in the 19th and early 20th century, while the third type represents those used in the 21st century. Of the few families who chose to bury several people under a single gravestone in the 21st century, all did so only for the death of an infant or young child. There were no cases of family gravestones used for adult families during this period in this sample. This suggests that unlike the first two family stone types, this gravestone is not chosen merely for economic reasons.

On average, 18% of the sample in this study was buried in a family grave. This number was slightly higher (23%) in the 19th century and nearly three times higher in the first half of the 20th century (53%). This option has become considerably less popular in recent years, however, with only 7-8% of those dying in the last 50 years using family stones. The median income has risen in recent years,[7] and laser-engraving has made engraving cheaper.[6] This suggests that economics likely played a major role in whether one was buried individually or with a family unit. In addition to economics, mortality rates also likely played a role in the use of gravestone type. Family stones were only the norm between 1900-1949. Under the weight of crises such as The Spanish Flu, World War I, and World War II, this period brought with it the lowest life expectancy of the 20th and 21st century by a wide margin.[8] Higher mortality rates may have led families to prefer cheaper burial options. Economics and the mortality rate are, together, quite useful in explaining the prevalence of family graves in the early 20th century and their rapid future decline.
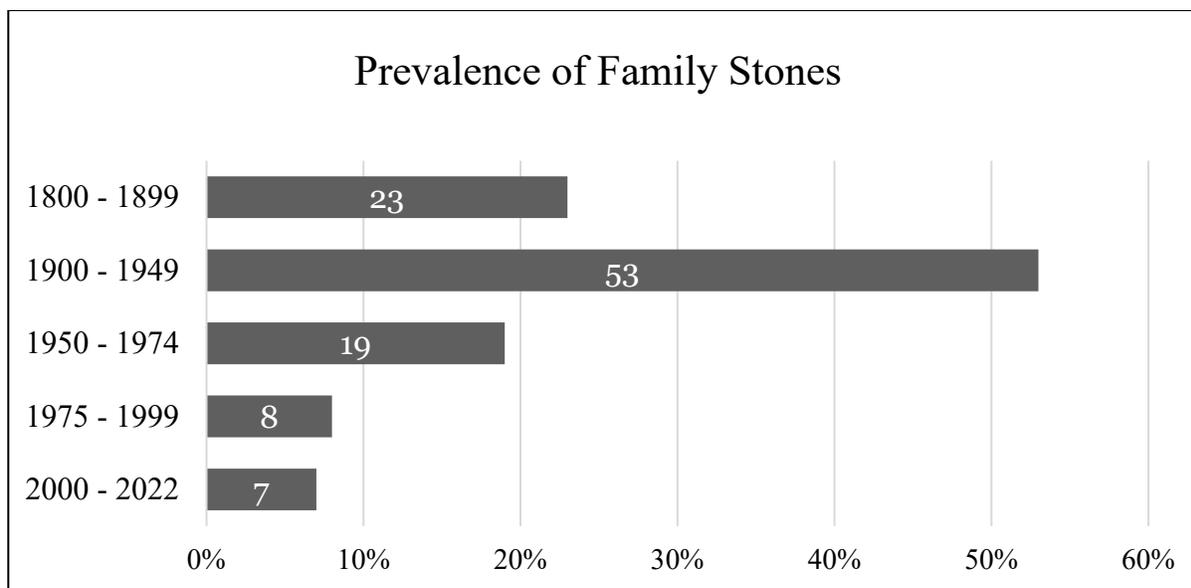

Figure 5. Prevalence of family stones.

Figure 6. The first type of family stone.

Figure 7. An individual marker of the family stone in Figure 6.

Figure 8. The second type of family stone.
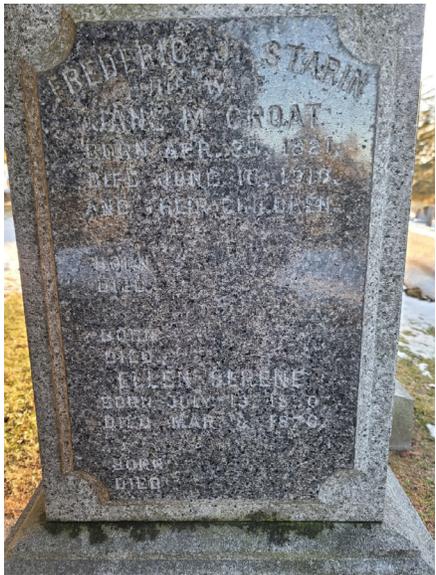
Figure 9. Another face of Figure 7.

Figure 10. The third type of family stone.

Gravestones and Temporary Decorations

In this sample, 22% of graves had temporary decorations such as flowers, pictures, books, or incense left at them. As one might expect, the older a grave was, the less likely it was to have received fresh decorations. Only 3% of the 19th century sample, or one single grave, had temporary decorations left by someone. Those who died in the 20th century ranged from 10-20%, while those who died in the 21st century were significantly more likely to have temporary decorations left at their grave (45%). Interestingly, graves in the Calvary Cemetery were significantly more likely to have temporary decorations left with them, at 29%, compared to 19%. This is true despite the samples from the Calvary Cemetery being disproportionately older than the Hillside samples – the average year of death being 1962 at Calvary as compared to 1976 at Hillside.
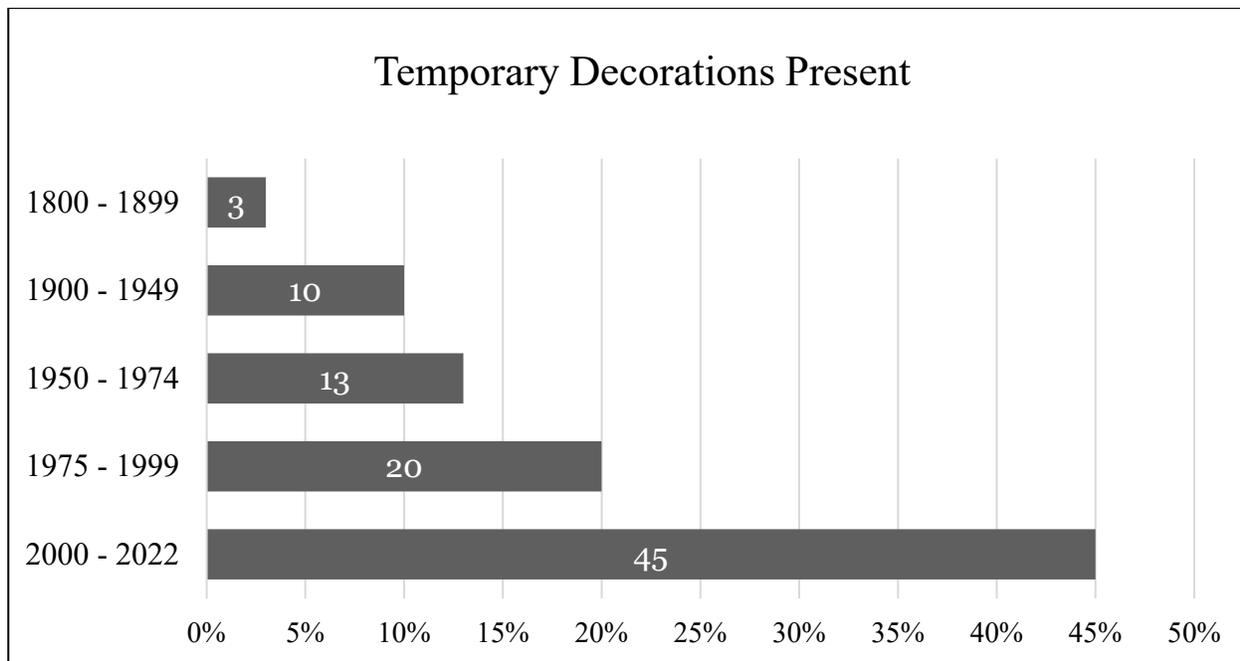

Figure 11. Temporary decorations.

Gravestones and Occupation

Recording the deceased's occupation was never popular in this sample. The simplest graves from the 19th century almost never included this detail – 3%, or one grave, did – while those in the 20th and 21st centuries included this detail about 8-10% of the time. When this detail is recorded, it is primarily from military veterans. Occupations listed that weren't military veterans included: firefighters, doctors, and professors. Only those with careers typically regarded as socially prestigious decided to record their occupation on their grave. Those who included their occupation on their gravestones tended to be buried alone; furthermore, only 10% of those who listed an occupation had included a family role (compared to 24% in the general sample), and only 12% included their date of marriage (compared to 24% in the general sample).

Gravestones, Dates of Marriages, and Family Roles

The treatment of women on gravestones has changed dramatically over the years in tandem with shifting social attitudes. For example, of the 39 gravestones measured from the 19th century, 15 of them included the description "wife of X." In many of these cases, the wife's name was never recorded, tying her identity exclusively to her husband. This description was unique to this period; furthermore, there was no single instance of any graves being marked "husband of," in this study's entire sample. Other family roles observed across all time periods included: father/mother (*sometimes* "of X"), grandfather/grandmother (of X), brother/sister (of X), aunt/uncle (of X), *etc.* The inclusion of family roles began dying out after this period and reached a low of 9% between 1950-1974. This information is becoming more common again on graves in the 21st century as gravestones become larger, more intricate, and more detailed. While this practice is becoming popular once again, social factors such as the relationship between men and women have changed significantly; as such, the treatment of men and women on gravestones has become much more egalitarian in recent years

On average, 24% of graves measured included information about the deceased's family role, while 76% did not. Those who died in the 19th century were the most likely to include this information on their grave, at 44%. The inclusion of one's date of marriage is a newer phenomenon. This did not occur once in the sample of 19th century graves, and only occurred 4-6% of the time between 1900-1974. This number jumped significantly to 25% between 1975-1999 and doubled to 51% in the 21st century. As graves continue to grow more intricate, one's marriage date seems to be among the quickest growing and most common pieces of information to be recorded on gravestones. The newer inclusion of marriage dates likely further reflects the cultural shift in which marriage is increasingly viewed as an egalitarian enterprise.
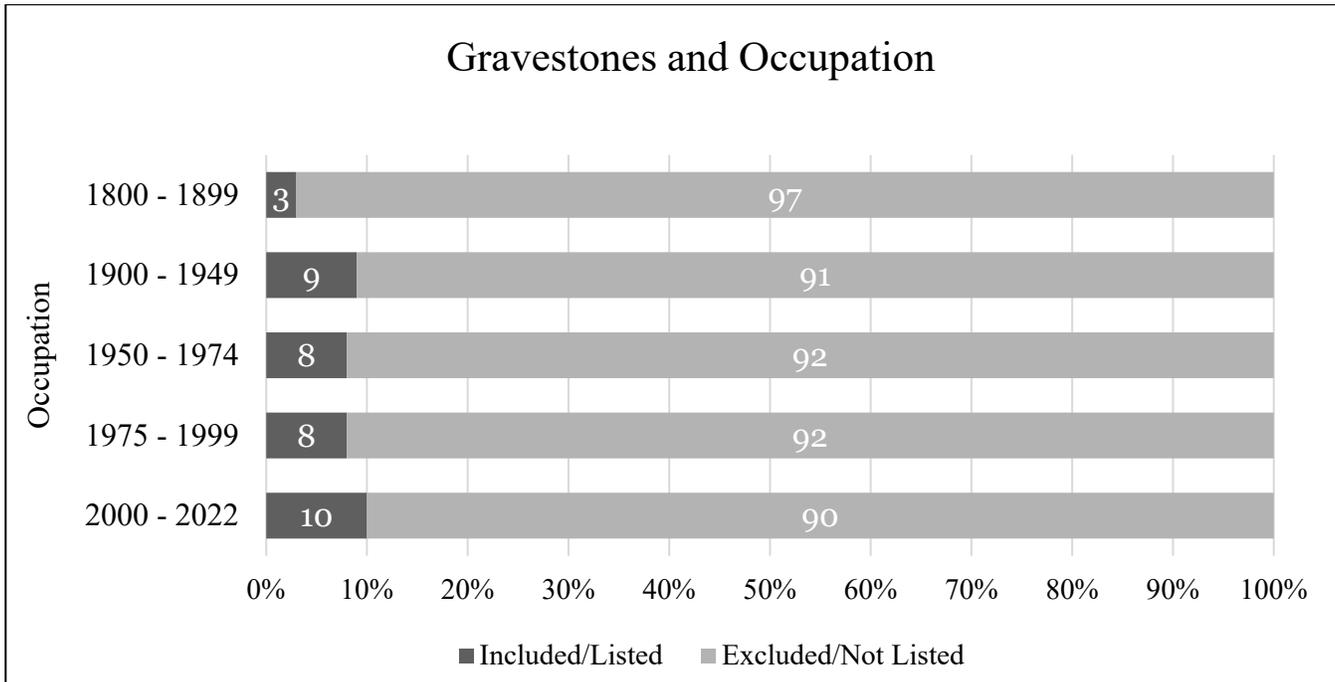

Figure 12. Gravestones and occupation.

Gravestones and Date of Marriage
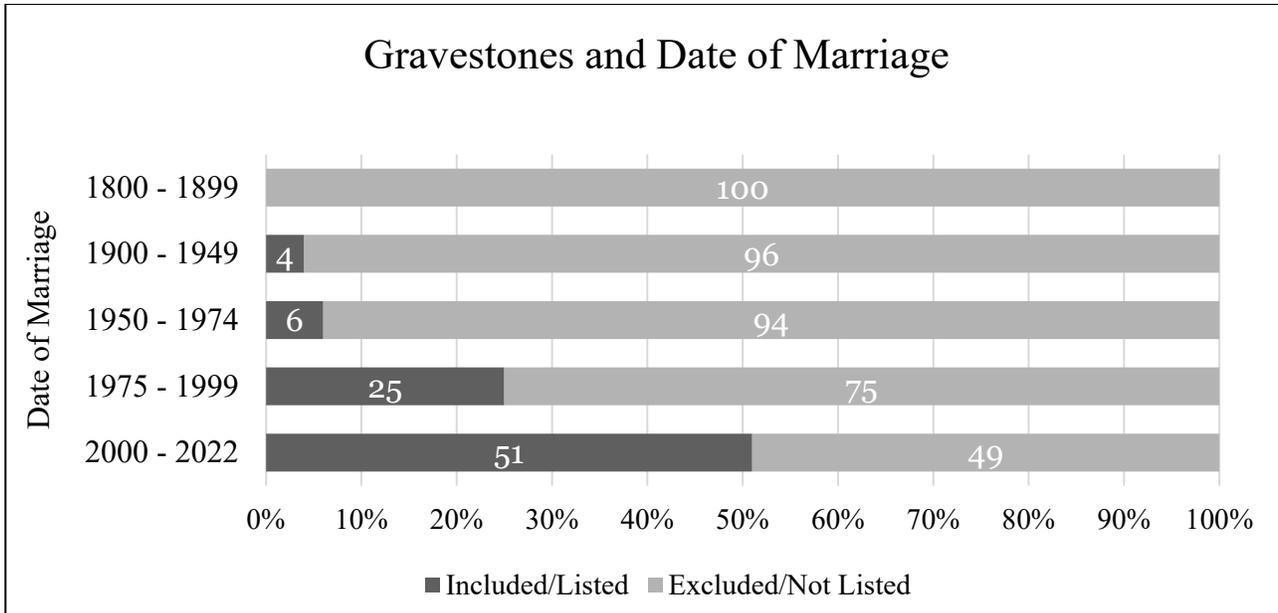
Figure 13. Gravestones and the marriage date.

Gravestones and Family Role
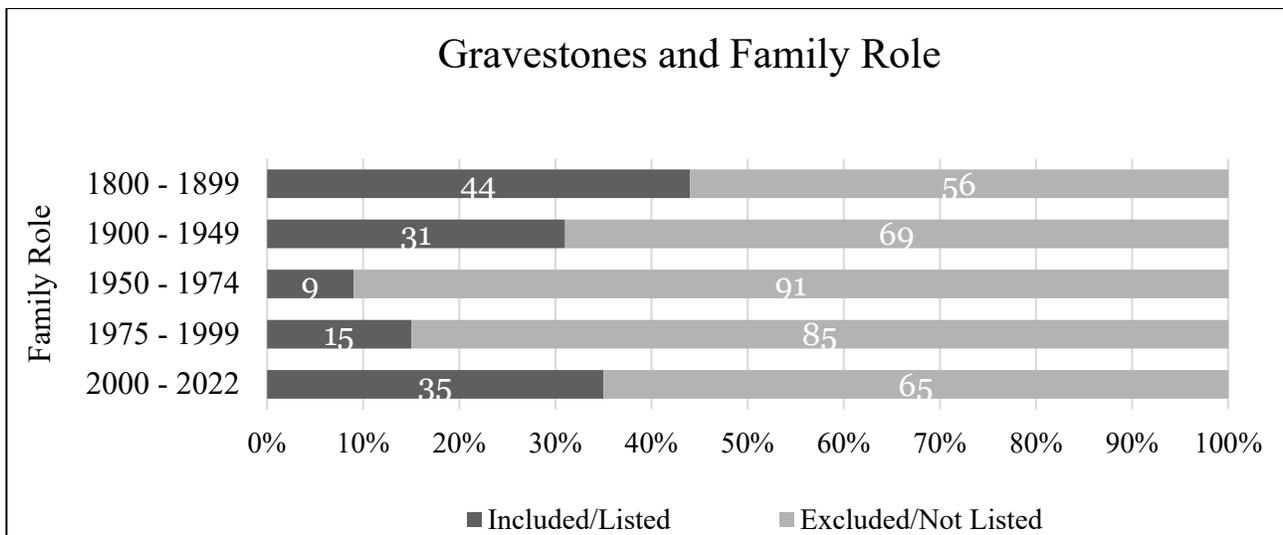
Figure 14. Gravestones and family role.

What Was Not Found

In taking up this project, there were some expected observations that were never found among any of the Whitewater samples. For example, there was not a single instance of a grave recording a non-scriptural or personal quote, poem, or epitaph. The only type of quotes observed on gravestones were from the Bible. This is somewhat of a surprise, given that previous research has features to be an important aspect of gravestones in some locations.[1, 2] The deceased's cause of death was also never recorded in these samples, which is quite in line with previous research.[1] Other types of information never recorded, but perhaps expected in rare circumstances, include personal accomplishments or awards (with the single exception of a purple heart recipient) and non-Christian religious symbols or quotations.

CONCLUSIONS

Summary

Over the years, gravestones in Whitewater, WI have grown increasingly complex and information-filled. People are using more symbols than ever before to express who they were and what they valued in life, even beyond religion. There has been no major shift in the number of religious symbols used since the 20th century, but non-religious symbols have become much more common. People are beginning to be buried alone at much higher rates than before, with 93% of people using an individual grave

in the 21st century, compared to only 47% in the early 20th century. As expected, temporary decorations such as flowers were most commonly left at recent graves, with fewer people choosing to honor older graves in this way. Finally, common forms of information about the deceased on gravestones included their date of marriage, which is a newer phenomenon in the 21st century, their military status if they were a veteran, and their role in their family. Graves continue to be an excellent form of memorial for the deceased and are useful reflections of the values and priorities of the lives they mark.

Limitations
Although every effort has been made to ensure this research project is as detailed and legitimate as possible, there remain some limitations of which the reader should be aware. First, the data for this study was collected over a short, 2-day period during the peak of the Wisconsin winter, cold, and snow. Accordingly, some measures, such as the presence of temporary decorations at gravesites, were very likely affected. Were this study to be replicated in the summer, there would very likely be different results for some measures. Furthermore, some graves which were originally randomly selected could not be analyzed due to being covered in ice, snow, mud, or moss. This may have shifted the sample set toward larger gravestones, which are less susceptible to being obscured, and newer gravestones, which often have more legible writing, especially in poor weather conditions. Future work could attempt to replicate these findings, as well as account for some of these limitations.

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PRESS SUMMARY
Cemetery and funeral practices have changed significantly throughout history, varying by time period, location, culture, and religion among many other factors. This project investigated gravestone customs of cemeteries in Southern Wisconsin, USA. Based upon a dataset of 500 gravestone samples collected from cemeteries in the area, this project measures how people choose to remember their dead and how these practices have changed over the years. Practices such as the recording of one's name and year of birth/death have generally remained constant; however, other customs of remembrance, such as the use of symbols, have shifted dramatically over the years, reflecting the changes of society and culture.