Urban Green Spaces as a Tool to Combat Loneliness

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ABSTRACT

Loneliness in urban and suburban areas is a growing issue, with subsequent significant mental and physical health consequences. Green spaces have been shown to improve the social cohesion and connectivity of communities, and so could potentially diminish the widespread loneliness that is present in cities. I surveyed individuals in the San Francisco Bay Area about their relationship with green spaces, and their self-reported loneliness levels. I further formed two groups– green space and urban space– to observe if simply being in green spaces had a lowering effect on feelings of loneliness. I then interviewed experts in the fields of green spaces and their social impacts, loneliness, and city planning, to learn important nuances in urban green space implementation and improvement. Frequency of visits to green spaces, reasons for visiting, and distance to closest green space all were important factors that affected loneliness levels in individuals. Further, I found that individuals that were present in green spaces–even when not interacting with others– reported feeling less lonely than those in an urban space group. Experts reiterated that comfortable spaces to gather and consistent programming were vital to increasing frequency of visits to green spaces. Further, parks authorities working with housing authorities to ensure affordable housing plans coincided with new green spaces are vital in avoiding gentrification.

KEYWORDS

social isolation, social connectivity, subjective well-being, environmental health, urban planning

INTRODUCTION

Loneliness is a growing epidemic in the US, with 36% of surveyed Americans reporting feeling lonely (Weissbourd et al. 2021). Only further exacerbated by the COVID-19 pandemic and the separations it caused, it is a major issue affecting huge numbers of our population. While there is differing evidence in the literature on if loneliness has significantly increased in the past few decades, at best it has not changed, and we are still left with a huge portion of the country feeling lonely (Ortiz-Ospina et al. 2020). Loneliness is defined as a negative emotion that comes about through a discrepancy between desired and achieved levels of social contact (Goossens et al. 2009). Loneliness is marked by feelings of painful isolation despite wanting social connections. While often accompanied by being physically alone, one can still feel lonely while being with others. The implications of loneliness are huge, as there are numerous health impacts that chronic loneliness can cause. Loneliness is known to be a major risk factor for depression, which itself accelerates functional decline and increases mortality rate. (Mehta et al. 2002). Further, there are negative health effects from loneliness at every stage of the life cycle. These include increases in blood pressure, inflammation, anxiety, and mortality rates (Hawkley and Capitanio 2015). Loneliness also has shown to increase susceptibility to infection by decreasing immune function (Cohen et al. 1997). The US Surgeon General Vivek Murthy also writes in his book *Together* about the growing issue of loneliness and how he considers it a public health epidemic due to its numerous negative effects on human health. While it's abundantly clear that loneliness is a pertinent issue that continues to persist, the literature and funding is lacking in potential solutions.

One way to potentially counter the issue of loneliness is through the implementation of urban green spaces in cities and suburban areas. Green spaces are parks, undeveloped land, and can include vegetation and water. They also are described as to provide ecosystem services, publically accessible vegetation, and open land or forests (Taylor and Hochuli 2017). They include land that are partly or completely covered with grass, trees, shrubs, or other vegetation, and in cities, these urban green spaces often include parks, community gardens, lakesides, and sports fields– to just name a few (Kabisch et al. 2015). Urban green spaces have shown to improve social cohesion and connectivity to communities, which could prove fruitful for

combating loneliness in these communities (Leavell et al. 2019). As a space where people can gather, participate and build community, urban green spaces allow for individuals to feel more connected to others (Leavell et al. 2019). With loneliness being the want but lack of social connections or the feeling of isolation from your community, green spaces can be a vital medium in allowing people to meet, be with, or at least feel more connected to others. And while the social connectivity that nature provides has been well documented, how this could positively affect those feeling lonely and isolated has not been looked at with nearly as much detail.

In fact, research has been conducted showing that just being in nature and outdoors have shown to have tangible positive impacts on well-being in individuals (MacKerron and Mourato 2013). But these have traditionally looked at places like national parks and large expansive nature preserves–which are ideal for these positive effects– but unfeasible for most to rely on for daily improvements in loneliness and general well-being, as the majority of Americans live in urban areas (Buckley 2020). Urban green spaces, on the other hand, can help occupy this unfilled niche. Much more common and easier to add to cities– and closer to where a majority of the population lives– the tangible improvements to well-being from being in nature can reasonably be felt through green space implementation. To combat loneliness at the highest scale, urban areas– in which 80.7% of the US population lives– should be the focus (US Census Bureau). These regions often have a stark separation from nature and a lack of abundance of communal spaces that exacerbates loneliness. Consequently, the most people can potentially be helped through green space intervention here. Through promoting social cohesion, individuals benefit both physically and mentally from spending time in green spaces, which provide numerous health benefits (Jennings and Bamkole 2019). And with the growing issue of prevalent loneliness, I believe urban green spaces can be implemented to promote this social cohesion in communities, and better the physical and subjective well-being of individuals, by reducing the pervasiveness of loneliness.

In this study I ask if urban green spaces can be used to counter the issue of growing loneliness and feelings of isolation in cities and suburban areas. With its background in promoting social cohesion, green spaces have shown to be vital in promoting community and bonds between people, and I believe that this has implications for potentially combating loneliness as well (Leavell et al. 2019). Loneliness is a vital public health issue with it correlating

with higher mortality rates and worse immune function (Hawkley and Capitanio 2015). Much research has been dedicated to the positive health benefits of green spaces, including their social affects, but little resources towards examining their relationship with loneliness– despite the significant impacts of loneliness on individuals' mental and physical health (Cohen et al. 1997). I will work towards answering this question by posing the following subquestions:

- 1) Do factors like distance, accessibility, frequency of visits to green spaces, reasons for visiting, and more affect the prevalence of loneliness in individuals?
- 2) Does simply being in nature/green spaces make individuals feel more connected to their community, and the people around them?
- 3) What are important factors to consider when implementing urban green spaces into cities–especially when the intent is to build social cohesion and connectivity?

Loneliness versus solitude

An important distinction needs to be made about what solitude is, and how it differs from the negative consequences associated with chronic loneliness. Solitude is voluntary, for example when people want some time to themselves but can return to social interactions when they feel they need connection and companionship. It further provides opportunities for creativity and exploration of oneself. (Long and Averill 2003). Although there are both positive and negative aspects of solitude, solitude's benefits most often outweigh its harm (Storr 1988).

The difference then is predicated on one's interpretation of an experience–that if someone craves human connection and belonging to no avail, then they would be classified as lonely (Rokach and Chan 2021). Whereas solitude expresses the glory of being alone, loneliness focuses on the pain of feeling isolated and alone (Cacioppo et al. 2010). At its core, being alone when we want and need to is what makes up solitude. Solitude and loneliness are similar in the sense that there does not need to be a great physical distance or barrier between yourself and others to feel either emotion. Aloneness is not an absolute necessary condition for solitude nor loneliness, as a person can feel lonely while in a crowd of people, or feel the positive side of it when on a hike surrounded by other groups (Long and Averill 2003). An increase in positive

feelings of freedom, creativity, intimacy, and spirituality are popular benefits associated with solitude (Long and Averill 2003).

These are in contrast with consequences of chronic loneliness, which include worsening mental and physical health outcomes at each stage of life (Hawkley and Capitanio 2015). And this is why I focus on loneliness in this study, as time alone is not what I aim to diminish, but rather my goal is to lessen the amount of people longing for meaningful connection that are unable to receive it.

How loneliness manifests in modern society

As more of the world's population continues to move into urban areas, yet resources and funding to combat loneliness and isolation have not increased to the same level relatively, loneliness is something that more people are at even high risk for in the present day. People of all age groups are showing increasing levels of loneliness, but for different reasons. Further, factors like where an individual lives, their gender, and race all are factors that can mediate how socially isolated they feel.

The present research shows the following about differences in how loneliness manifests in different populations, regions, and communities (Barreto et al. 2021).

Table 1. Effects of Different Variables on Loneliness

Variables that affect loneliness in different populations	**What is the effect?**	**Source(s)**
Age	➢ Inconsistent results, but many report no significant age differences in loneliness ➢ Instead, loneliness manifests in each age group but for different reasons ○ Adolescents and young adults struggle to conform to peer groups and develop independence and balance expectations of friends and family. ○ Middle-aged adults' loneliness is driven by work, income, separation, and/or reduced availability of time	(Larson et al. 1996) (Luhmann and Hawkley 2016) (Victor et al. 2005)

	because of caring or work responsibilities ○ And loneliness among older people often is due to the loss of their social network, reduced mobility, and isolated living situations.	
Gender	➢ Women are socialized to develop larger and more active social networks, potentially protecting them from loneliness relative to men ➢ Men are more reluctant to admit to feeling lonely, and face more stigma for it ➢ Present research supports that men generally as a result are more lonely than women ○ Though in old age women can feel more lonely as they tend to live longer than men. ○ Pregnant and postpartum women also tend to have higher feelings of isolation and feeling alone in their struggles.	(Okun and Keith 1998) (Borys and Perlman 1985) (Barreto et al. 2021) (Kent-Marvick et al. 2022)
Urban and rural areas	➢ Generally found that noncore and micropolitan rural residents report less loneliness and social isolation ○ (When adjusted for sociodemographic and health information) ○ And report having more social relationships than urban residents ➢ Rural residents were also more likely to be able to rely on family members than those living in urban areas.	(Henning-Smith et al. 2019)
Individualist or collectivist	➢ People living in more individualistic societies report more frequent loneliness than people living in more collectivistic societies ➢ The most vulnerable to loneliness were younger men living in individualistic cultures	(Barreto et al. 2021)
Race/ethnicity	➢ Lack of significant formal research of race and loneliness outside of Black and White Americans ➢ Older Black Americans had significantly higher rates of perceived isolation (a measure that combines both loneliness and social support items) than White individuals ○ They also had significantly higher rates of worse self-rated mental health in comparison to older White Americans ➢ Black and White Americans often live in racially segregated communities, and the	(Taylor and Nguyen 2020) (Miyawaki 2015) (Williams and Collins 2001) (Thayer and Anderson 2019) (Verdery and Margolis 2017)

	communities in which blacks reside are more likely to lack economic, and social resources, and are more likely to have greater physical degradation and other built environment hazards ➢ Black Americans frequently experience life situations that place them at greater risk for experiencing loneliness ○ including a greater likelihood of being impoverished, lower rates of marriage and higher rates of divorce, having fewer years of formal education, and frequently having worse physical health in comparison to White older adults ➢ Race significantly moderates the relationship between loneliness and depressive symptoms	
Socioeconomic status and neighborhood status	➢ SES declined with increasing loneliness (correlationally related) ➢ Individuals living in an area with high neighborhood social capital (most often neighborhoods that also were more affluent) and high individual social capital showed a lower likelihood of loneliness when compared with those with low individual social capital.	(Beutel et al. 2017) (Domènech-Abella et al. 2017)

Urban green spaces and their place in the Bay Area

Urban green space is defined as urban land, partly or completely covered with grass, trees, shrubs, or other vegetation. It includes parks and community gardens, but also rooftop gardens and vertical gardens, meadows and woods (De Haas et al. 2021). In the San Francisco Bay Area, these urban green spaces come in a variety of forms. In the larger urban areas, there are often large parks of greenery with tree cover, including Middle Harbor Shoreline Park in Oakland, Tilden Regional Park, Presidio of San Francisco Park, and Golden Gate Park. They are 1,220 acres, 2,079 acres, 1,491 acres, and 1,027 acres in area, respectively. These larger spaces in the Bay Area often include hiking trails, play spaces with vast greenery, benches, tree cover, and close proximity to bodies of water. They often have varying landscapes too, such as valleys, forests, and beaches. These parks are well-funded, and see hundreds of thousands to millions of visitors per year. There consistently is programming, events, and communal activities taking place at similar parks of over 1000 acres. The majority of the Bay Area though is filled with

suburban green spaces and parks that can often range from 0-120 acres in area. These are in suburban communities in the South, East, and North Bay counties. They are in closer proximity to homes and residential areas than the larger parks, and cater to young children more as well– they often have playgrounds, and regions with "kid-friendly" floors. These parks still have open grass fields and benches with tree cover, but will usually lack trails and a varied landscape.

The issue of equity with green spaces

Any discussion of green spaces and parks is incomplete without a close look at how to avoid further gentrification and to work towards improvements in green spaces being equitable to all communities, including low-income and communities of color. In interviews I conducted with experts in the field of city planning, loneliness, urban parks and green spaces, one of my focuses was on how green spaces could be implemented or improved without further fragmentation of communities. Several studies have evaluated the role of socioeconomic status (SES) on the distribution of green spaces and reported consistently that neighborhoods with higher SES levels enjoy greater accessibility to green spaces (Wen et al. 2013). Further, limited evidence also shows that regions with a higher percentage of Black and Hispanic residents are more likely to have less coverage of green spaces (Wen et al. 2013). These disparities in access have shown to lead to significant health disparities as well. This suggests that green spaces can be a tool to advance equity in health outcomes and to address disparities that exist between neighborhoods of varying SES and racial/ethnic make-up (Rigolon et al. 2021). But studies have shown moderate associations between green spaces and gentrification trends, and so it becomes imperative to work with community organizations, focus on community engagement and feedback in these projects, and early intervention with housing associations, developers, and city planners (Schinasi et al. 2021).

METHODS

Survey

To see if factors like distance, accessibility, frequency of visits to green spaces, and reasons for visiting affect the prevalence loneliness in individuals, I conducted a survey of people who live within the 9 San Francisco Bay Area counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties. This region is primarily urban and suburban, and provides a wide range of socioeconomic and demographic diversity.

To disseminate the survey to a wide variety of communities with varying access to green space, I reached out to organizations associated with TOGETHER Bay Area, which is a coalition of local Native governments, organizations, communities, nonprofits, and public agencies working locally in the San Francisco Bay Area. This included the regional park districts of the various counties within the Bay Area, along with Parks and Parks Foundations for each county. Further, I reached out to state parks and land trusts in the region as well. I also contacted restaurants and businesses in the Bay Area with mission statements of environmentalism.

In the survey, I asked:

- Zip Code
- Distance to closest green space/park
- How easy to access that green space? It is easy to access that green space (may be better)
- How do you usually get there?
- Is there public transportation to get there?
- How would you rate the quality of that green space?
- In the last month how often have you visited green spaces?
- How often do you generally visit green spaces?
- Why do you go to green spaces/parks?
- What would make you most likely to visit more often?

Zip code was chosen rather than city of residence as large cities have multiple zip codes that have discrepancies in access to parks and green spaces. Zip code also provides more exact

data on income levels of the average respondent. Further, I aimed to learn about respondents' access, motivations, and relationships with existing green spaces and parks.

The green spaces questions were followed by the UCLA Revised Loneliness Scale (Table 2). This scale quantifies loneliness levels with a total score ranging from 20 to 80. Higher scores indicate higher loneliness. The most commonly used categorization is the following: 20–34 denotes a low degree of loneliness, 35–49 a moderate degree of loneliness, 50–64 a moderately high degree of loneliness, and 65–80 a high degree of loneliness.

Table 2. UCLA Revised Loneliness Scale

Scale:
INSTRUCTIONS: Indicate how often each of the statements below is descriptive of you.

Statement	Never	Rarely	Sometimes	Often
1. I feel in tune with the people around me	1	2	3	4
2. I lack companionship	1	2	3	4
3. There is no one I can turn to	1	2	3	4
4. I do not feel alone	1	2	3	4
5. I feel part of a group of friends	1	2	3	4
6. I have a lot in common with the people around me	1	2	3	4
7. I am no longer close to anyone	1	2	3	4
8. My interests and ideas are not shared by those around me	1	2	3	4
9. I am an outgoing person	1	2	3	4
10. There are people I feel close to	1	2	3	4
11. I feel left out	1	2	3	4
12. My social relationships are superficial	1	2	3	4
13. No one really knows me well	1	2	3	4
14. I feel isolated from others	1	2	3	4
15. I can find companionship when I want it	1	2	3	4
16. There are people who really understand me	1	2	3	4
17. I am unhappy being so withdrawn	1	2	3	4
18. People are around me but not with me	1	2	3	4
19. There are people I can talk to	1	2	3	4
20. There are people I can turn to	1	2	3	4

Scoring:
Items 1, 4, 5, 6, 9, 10, 15, 16, 19, 20 are all reverse scored. Keep scoring continuous.

I compared numerical summary data of loneliness levels based on frequency of visits and reasons for visiting green spaces. I further used ANOVA testing to compare significance of the differences in loneliness levels for these two variables. I finally used the Pearson correlation coefficient to find the strength of the correlation between distance to green spaces and loneliness levels, along with the correlation between rated quality of green spaces and subsequent loneliness levels.

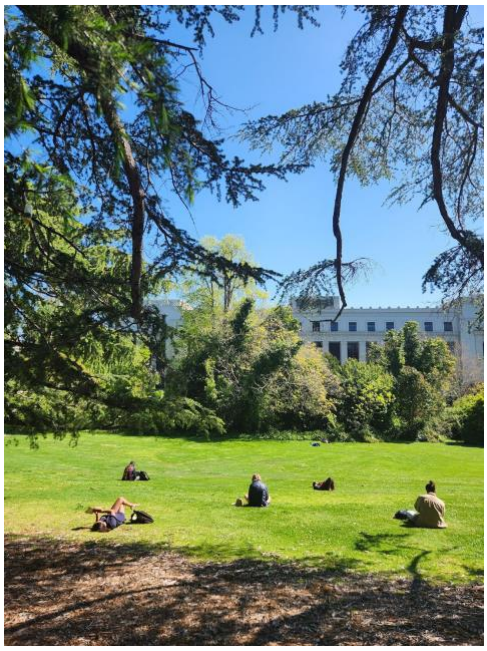
"Experiment"

To see if simply being in green spaces–even when not interacting with others–lessens feelings of loneliness and isolation, and instead makes individuals feel more connected to their community, I surveyed loneliness levels in participants randomly assigned to a green space or an urban space condition. The participants were 60 university-aged students at UC Berkeley, with 30 in each of the two groups. Ages of participants ranged from 18-22, with the mean age being 20. There were 30 male and 30 female participants. Race breakdowns were as follows: 23 Asian, 22 White participants, 6 Black or African American, 6 Hispanic or Latino, and 3 Native Hawaiian or Other Pacific Islander participants.

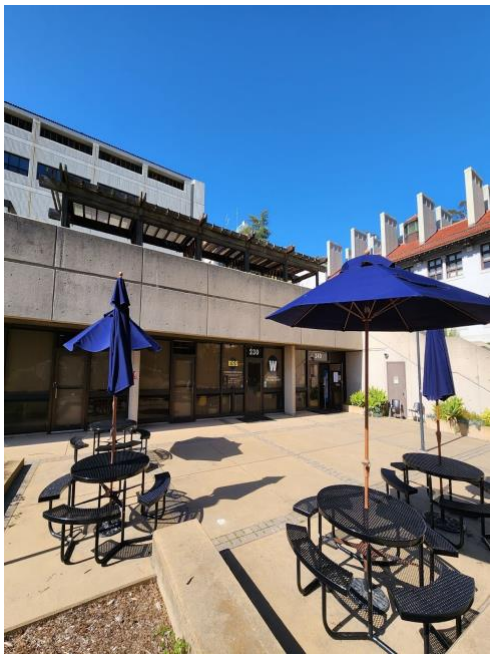
I used Piff et al. (2015) as a baseline for my methods. In that research, researchers looked at awe and subsequent prosocial behavior that it motivated. They did so by having two groups–one in a grove of tall trees and the other facing a building. I co-opted this method with one group being in a green space and the urban group being in an area lacking significant greenery or tree cover. I used the UCLA Loneliness Scale again to observe if there were any differences in loneliness between these two randomly assigned groups. Participants were randomly assigned their group, with an equal number of male and female participants in each group. Average age for green spaces and urban space groups were 19.93 and 20.06, respectively. In the green spaces group, 40% were Asian, 33.3% White, 10% Black or African American, 10% Hispanic or Latino, and 6.7% Native Hawaiian or Other Pacific Islander. In the urban space group, 40% were White, 36.7% Asian, 10% Black or African American, 10% Hispanic or Latino, and 3.3% Native Hawaiian or Other Pacific Islander.

To ensure that the environment that the participants were in was registered by each participant, I had each participant complete a grounding method used to lessen anxiety and ground one in their environment. It includes having participants notice 5 things they can see, 4 things they can physically feel, 3 things they can hear, 2 things they can smell, and 1 thing they can taste (Neri 2010). Participants would spend 5 minutes in their location, followed by them completing the survey documenting demographic data along with their loneliness levels. Each participant would complete the intervention and survey by themselves, with no other participants present at the time. All participants were surveyed over a 2 week period.

Participants in the green space group were in a large green space on the west side of the UC Berkeley campus. Those in the urban space group were also on the UC Berkeley campus, in a small plaza near the engineering department, surrounded by concrete and large buildings.



Green space on UC Berkeley campus



Urban space on UC Berkeley campus

I analyzed the data using a two-tailed, two-sample, equal variance t-test to compare mean loneliness levels between the green space and urban space group.

Interviews

To discover important factors to consider when implementing urban green spaces into cities–especially when the intent is to build social cohesion and connectivity, I conducted interviews with 4 experts in the fields of loneliness and social isolation, green spaces and their social implications, and urban planning. The interviews were semistructured long form interviews, lasting between 45-60 minutes each. Interviews were recorded with the participants' permission.

Table 3. Interview Questions

Theme	**Questions**
Green Spaces and Social Cohesion & Connectivity	● Important nuances and considerations when thinking about implementing or improving green spaces? ● What must be a focus if our goal is to lean into green spaces' power to improve social cohesion and connectivity? ○ What aspects of green spaces should be a focus? ■ easy access for all? events and communal activities? benches, sitting areas, tree cover? ● What makes community building happen at these parks? ● Is it more cost effective to improve or add new green spaces? ● What role do art and murals play in social cohesion within parks?
Loneliness	● What can you say about loneliness? Why is it an important thing to try and combat? ● In your opinion, are enough resources being put into trying to decrease loneliness? ● Is there a certain population or demographic that you've seen is most vulnerable, especially in urban areas? ● Is there an effective "one-size-fits-all" approach to reducing loneliness?
Equity and Gentrification	● How to maintain or improve spaces without displacement (gentrification)? ● How to make/keep urban green spaces equitable? ● What steps can city planners take to try to ensure we don't gentrify the community in which green spaces are being added or improved? ● How to ensure that these improvements are in communities that need them the most, not just affluent neighborhoods?

I analyzed the interviews by first transcribing them using Rev Transcription software, and then by using Taguette– an open-source web-based document tagging tool for qualitative data analysis. These tools allowed me to find common themes, phrases, nuances, and ideas between the conversations I had with the various experts in their fields.

RESULTS

Survey results:

I received 151 survey responses from all 9 Bay Area counties over the course of a 4 month period (Figure 1).

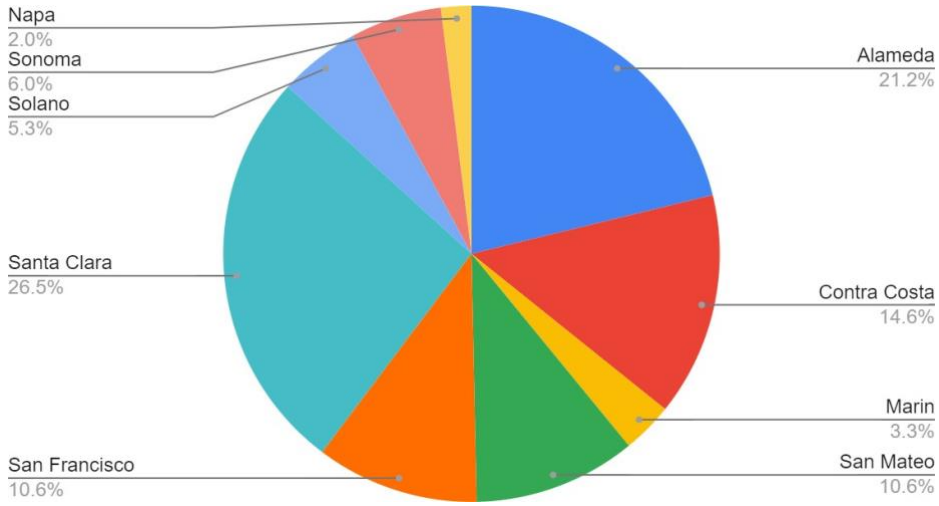


Figure 1. Counts of Counties

Frequency of visits to green spaces had a significant effect (p=2.2e-16) on the loneliness levels of respondents. There was a decrease in loneliness at each level of increasing frequency of visits to green spaces– with the lowest reported mean loneliness levels (29.00) for respondents who visited green spaces daily, and highest reported mean loneliness levels (48.75) for respondents who visited once per month (Table 4, Figure 2).

Table 4. Summarized Loneliness Data by Frequency of Visits to Green Spaces

Frequency of Green Spaces Visits	**Mean Loneliness Levels**	**Standard Deviation**	**IQR**	**0%**	**25%**	**50%**	**75%**	**100%**	**n**
Once a Month	48.75000	4.399675	5.0	44	46.25	47.5	51.25	57	8
Every Other Week	42.72340	4.451195	6.0	34	40.0	42.0	46.00	54	47
Once a Week	35.77419	2.376407	2.5	30	34.50	36.0	37.00	40	31
Multiple Times Per Week	32.05263	1.826600	2.0	28	31.00	32.0	33.00	39	57
Daily	29.00000	1.309307	2.0	27	28.00	29.0	30.00	31	8

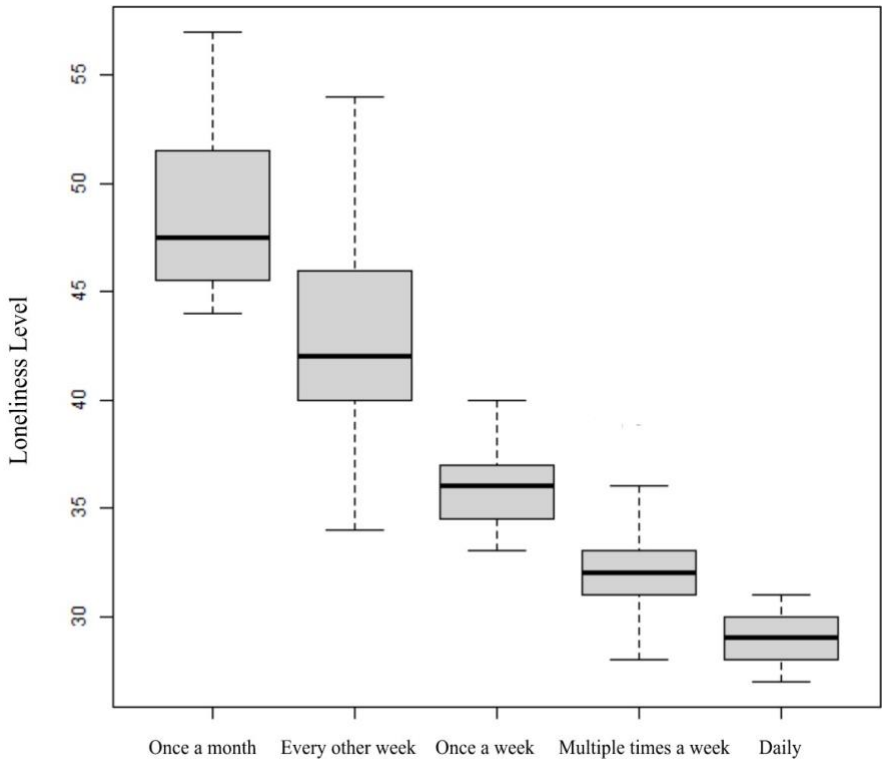


Figure 2. Loneliness by Frequency of Green Space Visits

Distance to the closest green space had a strong positive correlation (r=0.53) with levels of loneliness in individuals (Figure 3).

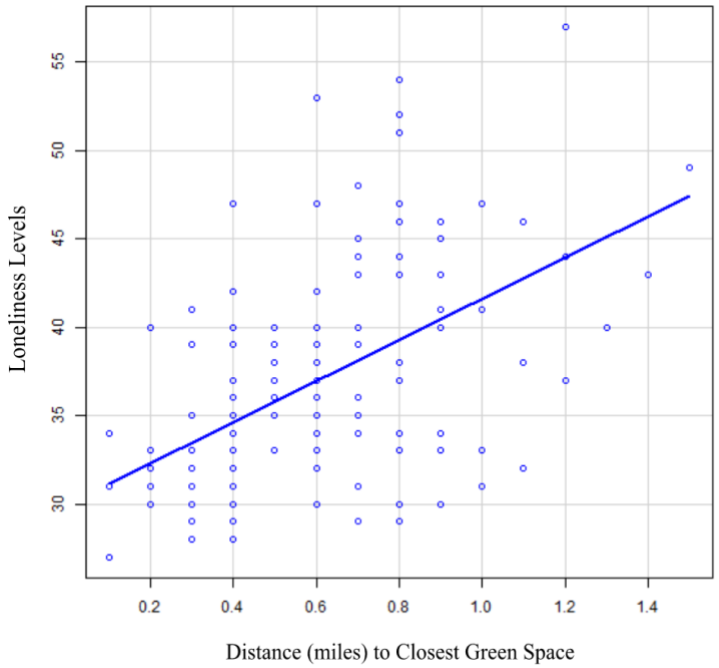


Figure 3. Scatterplot of Distance to Closest Green Space and Loneliness Levels

Why respondents visit urban green spaces and parks also had an impact on their self-reported loneliness levels, with those visiting primarily to be with family and friends having the highest mean loneliness levels (40.50) of any group (Table 5, Figure 4). There was a significant difference (p= 0.00031) in loneliness levels between the groups for primary reasons for visiting green spaces.

Table 5. Loneliness Levels Loneliness Levels by Primary Reason for Green Space Visits

Primary reason for visiting green space	**Mean Loneliness Levels**	**Standard Deviation**	**Median Loneliness Levels**	**n**
Communal recreation events/park programming	36.36111	5.221673	34.0	36
To be physically active/ Exercise	35.89286	6.349916	33.0	28
To be with family and friends	40.50000	6.946708	39.5	38
To be close to nature	34.95918	5.526298	34.0	49

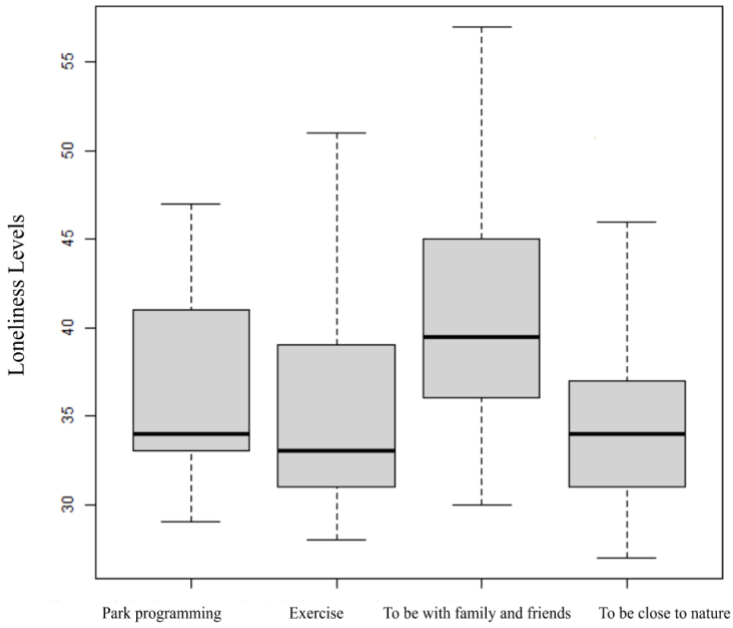


Figure 4. Loneliness Levels by Primary Reason for Green Space Visits

Respondents also rated the quality of the green space that was in closest proximity to them, on a Likert scale of 1 to 5, and there was a moderate negative correlation (r=-0.35) between rated quality of the green space and subsequent loneliness levels of the respondent (Figure 5).

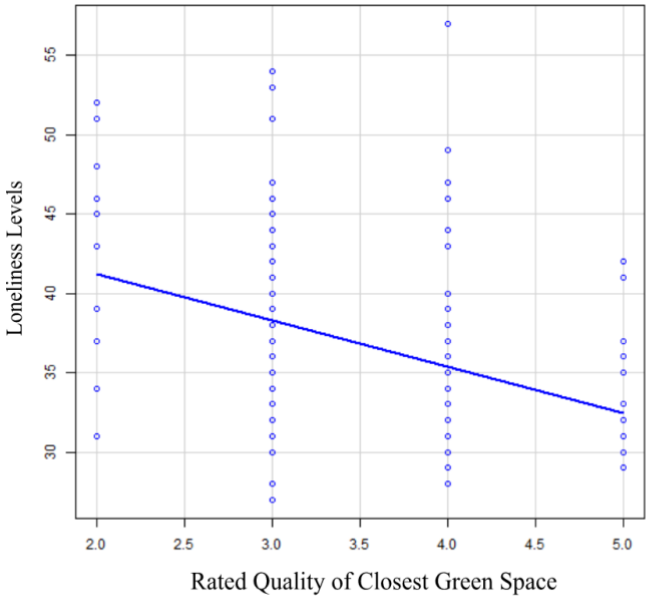


Figure 5. Scatterplot of Rated Quality of Green Space and Loneliness

More comfortable sitting and tree cover followed by more events and programming at parks were the two factors that most respondents reported would make them more likely to visit green spaces (Figure 6)

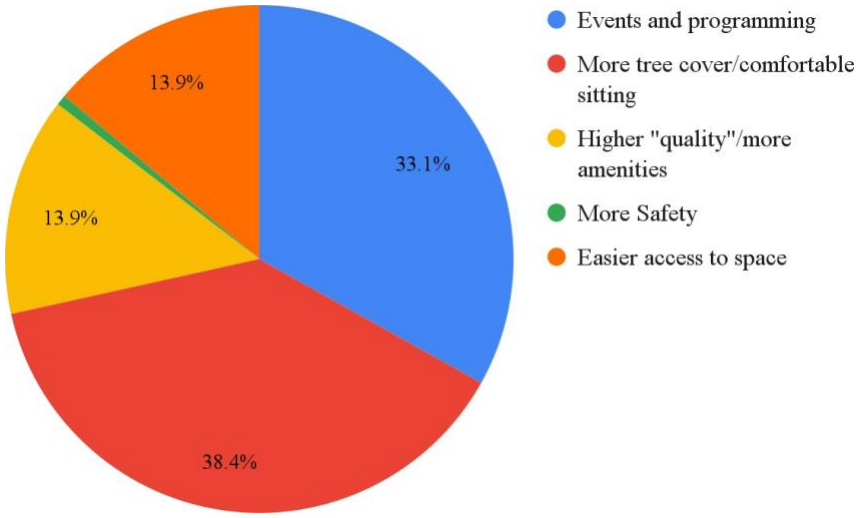


Figure 6. What would make respondents visit green spaces more often?

"Experiment" results:

Individuals in the green space group had a significantly lower loneliness level (p=0.0023) compared to those in the urban space group, with green space to urban space mean loneliness levels being 41.16 to 48.7, respectively; median loneliness levels were similar at 40 for the green space group and 48 for the urban space group. (Figure 7).

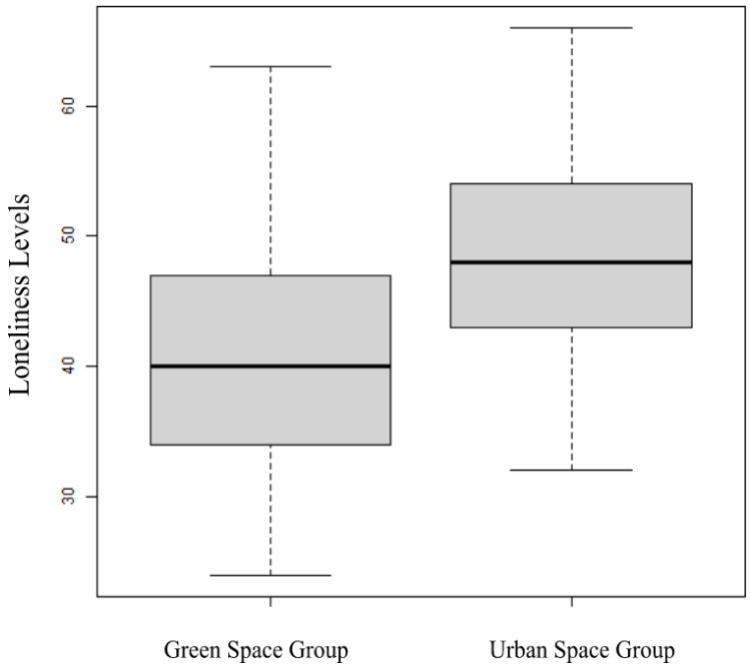


Figure 7. Loneliness Levels Based on Current Environment

Interview results:

I interviewed Ashby Lavelle Sachs, Louise Hawkley, Viniece Jennings, and Phil Ginsburg. Experts focused on their discussions on urban green spaces' ability to promote social cohesion, risk factors and effects of loneliness, and how to promote equitable access and limit displacement with new and improved green spaces. Researchers emphasized providing comfortable spaces for gathering and consistent programming as important aspects of green spaces in promoting social cohesion. Further, they discussed avoiding gentrification and displacement by having housing and parks authorities work in tandem, and emphasizing affordable housing when adding new green spaces to a community (Table 6).

Table 6. Summarized Key Ideas and Themes from Interviews

Theme	**Key Ideas From Interviews**
Green Spaces and Social Cohesion & Connectivity	Literature is lacking in terms of looking at qualities like biodiversity and types of "greenery" and their affects on social connection for humans in that space Tree cover has consistently been found to be important in promoting social

	cohesion; adds to the comfort in green spaces Having comfortable spaces to gather and sit within parks is key for community building Green social prescribing: creating group activities that people are referred to for people that are screened positively (during primary care) for loneliness. Can be referred to a social program. The successful social prescribing often is informal and regular Programming: having regular, informal programming at parks and green spaces have shown to be most effective; open and welcoming to new-comers
Loneliness	Loneliness levels are skyrocketing across demographics, everyone can benefit People coming out of prison, people coming back from war/military service, mothers, teen parents, elderly especially All need connection, applies to everyone Detrimental to mental and physical health Indicator of the overall health of a community and society If people are lonely, then the society is failing to unite and build the community, leads to further separation and crises of despair, extremism A way to neutralize huge societal problems that we may not know how to solve (like political and ideological extremism, high depression and suicide rates) is to get people to connect and be with one another, to "feel human" To build more resiliency into our culture
Equity and Gentrification	Green spaces won't benefit a community if it prices them out of their own neighborhood Need to partner with the housing authority in the community, to ensure that there is new housing going along with the new park/green space, or even if you're adding new amenities to a park Land banks to secure the property values; acquiring and holding strategically valuable properties until the community can develop them as affordable housing Parks department needs to partner with the housing department Hire local people to build and work on projects in their own communities; people want to have and feel ownership in their neighborhoods

	Equity Zones: map equity zones and certain percentages of new parks go into the areas that most need it Equity parks projects: measuring equity using data to counteract biases and tendencies to add green spaces and parks primarily into more affluent areas

DISCUSSION

I found that urban and suburban green spaces do have the ability to make people feel more connected to their communities and less socially isolated from one another. Greater frequency of visits to green spaces and closer proximity to these spaces were strong predictors of lower loneliness levels in individuals. I further found that just being in green spaces– even when not interacting with other people– lowered average loneliness levels in individuals compared to people in an urban environment. Experts further provided context, explaining that comfortable places to gather, and consistent programming that was open to newcomers, and ensuring housing and parks authorities are working in tandem were all essential to promoting social cohesion, and ensuring new or improved green spaces didn't exclude or displace members of the community.

Factors that mediate the relationship between green spaces and loneliness

The frequency of visits to urban green spaces and parks showed a consistent trend in relation to loneliness– namely that those who visited green spaces most frequently reported the lowest loneliness levels, and those who visited least frequently reported the highest loneliness levels. This trend was true for the intermediate visits too, and not just the extremes, as average loneliness levels consistently dropped as green spaces visits increased, from once a month to once every other week, all the way to daily visits. This was in line with previous findings, showing that happier people were so because of their time spent in nature, and not the other way around (Buckley 2020). This result reveals the importance of emphasizing and promoting visits to green spaces and nature as a strong means to connect a community.

Quite related to how often people visited green spaces, the distance from respondents' homes to their closest green space had a moderately strong direct correlation with loneliness levels. This meant that individuals who lived further away from green spaces tended to report

higher levels of loneliness compared to those who lived relatively closer. Living further from these spaces that tend to promote community building and togetherness, can lead to feelings of exclusion, due to a systemic shortage of opportunities to participate in society (De Haas et al. 2021). This result seems to go hand-in-hand with the implications from the findings on frequency of visits, as being further away from green spaces likely will decrease the amount of visits to said space. Improving access to green spaces, through implementation of new parks in areas devoid of them, or by improving public transportation options to promote visits when adding new spaces is economically unfeasible is vital in equitably sharing the positive affects seen from green spaces.

Interestingly, the primary motivations for visiting green spaces also seemed to have an effect on loneliness levels of respondents. Those who visited primarily to be with friends and family showed a significantly higher average loneliness than any groups' reason for visiting green spaces, all of which were relatively similar in their loneliness averages. This at first glance seems to be counterintuitive, as green spaces have been established as locations where people gather and build community (Leavell et al. 2019). But, a reason for this may be because people who went primarily to be with others were unable to build a regular habit of visiting green spaces. Those who visited for exercise, to be with nature, and park programming– the other three categories– may have been better able to implement a consistent practice or habit, while those who visited to be with others are more reliant on the schedule and availability of others in planning visits to green spaces.

The self-rated quality of the green spaces in closest proximity with respondents homes also had an impact on loneliness levels, as there was a moderately weak negative correlation between quality and loneliness levels. This manifested as those who rated their green spaces as higher quality reporting feeling less lonely, and those who rated their green spaces as lower quality reporting more feelings of loneliness and social isolation. Previous research on the mental and physical health effects of quality and amenities like tree canopies and vegetation in green spaces support this finding (Nguyen et al. 2021). This reveals that the quality of green spaces, beyond just quantity, is important in promoting social connection. This must play a part in park planning, that providing amenities for comfort and natural beauty are important, and play a significant role in visitors' experiences in these parks.

When asked what would make them visit green spaces more often, respondents again reiterated that tree cover/comfortable gathering and sitting areas, along with park programming were the most important factors. Notably, a relatively lower percentage of respondents said that the quality of the green space would affect their frequency of visits, providing an interesting nuance to the previous finding. While respondents themselves don't seem to rate better amenities as more likely to get them to visit, we do again see that it does seem to correlate with them feeling less lonely when they do visit green spaces. Improving comfort through tree cover and benches, along with larger areas for gathering, coupled with frequent programming at parks seem to be essential in getting more visits to parks, while extra amenities beyond that seem to help facilitate connection once individuals are already at the park.

Can your environment alone make you feel more connected?

Individuals in the green space group reported significantly lower loneliness levels than those in the urban space group, lending credibility to the argument that your environment alone can have a significant impact on how connected one feels to their community and the people around them. A previous study found that individuals' proximity to parks were positively associated with their sense of community and belonging (Jennings and Bamkole 2019). And a similar study to my own looked at subjective well-being (which is often strongly associated with social connectedness), finding that participants were significantly and substantially happier in an all-green or natural environment compared to in urban environments (MacKerron and Mourato 2013). In my study, both the green space group and urban space group were nearly identical in average age, all were UC Berkeley undergraduate students, and the racial breakdown of both groups were quite comparable. The only clear difference between the groups is in their environment, and so the differences in loneliness levels is likely greatly in part due to the environment that the participants did their grounding method in. The implications of this finding are large, as it provides evidence that just being in green spaces can make people feel less lonely, even when not taking part in an activity, or being there with friends or family. This finding also seems to support the finding about the effects of the motivations for visiting green spaces, namely that being with others is not a requirement for lowering loneliness levels in parks and

green spaces, but rather that there seems to be an inherent nature about these spaces that facilitate connection.

What do the experts think?

Experts discussed the specifics of urban design that could be used to combat social isolation and loneliness, along with potential ways to avoid gentrification when implementing new parks and green spaces. In promoting social cohesion, researchers focused on a few specifics that they mentioned as essential to green spaces and parks when the goal is lowering feelings of loneliness in a community. They emphasized that tree cover, benches, just generally comfortable spaces to gather at parks was hugely vital, and my survey data, among previous research backed up this claim (Nguyen et al. 2021). Beyond that, researchers went into specifics about what kind of park programming and events were most useful for building community. They mentioned that park programming needs to be informal and regular, to promote consistent visits to green spaces and so that no one in the community feels excluded. If programming or events at parks are too formal, they tend to be unwelcoming to newcomers, and so when planning for new events at parks, focusing on providing a space each week to welcome new or first-time visitors at these events could play a huge role in promoting consistent visits, which is vital in lowering loneliness levels. Researchers also touched upon the importance of this work, as they described loneliness as something that is increasing in prevalence across all age, gender, and ethnic demographics. While they did describe some specific groups as being even more susceptible to feelings of intense loneliness and isolation, and benefits can help broadly across the varying demographics. They also alluded to green spaces and resources going into studying the affects of loneliness as essential since combating it could provide solutions to problems we otherwise don't know how to address. They specifically mentioned that with the rise of political and ideological extremism, even small steps to bring people together, to promote connection, and cohesion within a community can help mitigate some of these issues. They described the amount of loneliness in a society as a sort of litmus test of the strength and resilience of a community, and so to increase the reliance and connectivity in face of hardship, that we needed to promote ways to feel more connected to those in your community. An important part of connecting with a whole community though is ensuring that the green spaces we're adding or improving on aren't

displacing people already living in the region. The researchers and urban planners also discussed the issue of gentrification and equity of green spaces. They mentioned that parks authorities must work closely with the housing authorities when trying to implement new green spaces: affordable housing must be added in along with the new parks, or else people likely will be priced out of their own hometowns. At its core, the researchers emphasized that green spaces and parks need to go in communities that need them the most, and that mapping equity zones, as the city of San Francisco has begun to do, is a way to combat the biases in urban green space planners. In all, they reiterated that if green spaces have the ability to connect communities and make people feel less isolated, we need to ensure that these benefits are equitably shared among all, since loneliness is a problem that has affected all socioeconomic groups.

Synthesis

Urban green spaces have then been shown to decrease loneliness and feelings of social isolation in individuals, and have the power to make people feel more connected to their communities. Both as a place where people gather to build community, and just in its seemingly inherent properties as green places of nature, urban green spaces can play an important role in connecting people to their communities, and thereby improving their mental and physical health outcomes. To amplify these results, we must promote frequent visits through easier access to green space, more programming that is consistent and welcoming to newcomers, and by adding amenities that improve comfort and ability to gather in these spaces, like abundant tree cover and benches. Through it all though, a focus must be placed on ensuring that the effects of green spaces are helping those who need them the most, and that we are not displacing those individuals in the process of adding or improving upon these parks.

Limitations

To answer my second subquestion, loneliness levels were measured at only one time, immediately after the grounding method was completed. Because of this, I am unable to know if the effect on levels of loneliness is temporary or long-lasting. Further, I’m unable to know based on my study if the social connectedness that individuals seemed to feel when they were in green

spaces lasts beyond the visit, or if the positive effects are greatly diminished immediately after leaving the green space or park. Further, for my survey I studied only the 9 Bay Area counties, which are not representative of the entire US population in income, access to outdoor recreation, preserves, and parks. Because of this, results cannot be broadly generalized across the entire country with full confidence.

Future directions

The next steps of research beyond this could look more specifically at historically redling and environmental racism, and how policies may have manifested into regions that show significant differences in loneliness levels. Further, while I touched upon the quality of green spaces, it would be interesting to look closely at how much quality mattered for lower income communities, as green spaces can often serve as a climate refuge in these communities– some of the only spaces for them to cool down in the hot summers. Looking closely at privatization of green spaces can further provide more context into how parks and green spaces can actually exclude individuals as well. In many communities, green spaces are abundant and close by but still inaccessible due to this privatization, and so observing the potential effects of this on loneliness is an important next step. More broadly, I'm interested to see if the effect of green spaces on loneliness differs between lower and higher income areas– if it has a stronger impact for one of the groups, and to see why this may be.

Broader implications

Loneliness is strongly associated with many negative health outcomes, and since the abundance of green spaces and parks are strongly linked with historical redlining, this is an environmental health issue. But improving to, and adding green spaces to areas that need them, along with making it easier for people to visit more often can help mitigate this. Urban green spaces can be used to strengthen the social connectivity of a community, and lessen feelings of isolation that can lead to harmful physical and mental health outcomes. This potential part of the solution is not limited to a certain region or a certain demographic, and so it can be used to combat loneliness across varying regions and cultures.

ACKNOWLEDGEMENTS

My biggest thanks to Patina Mendez and the whole teaching team from ESPM 100ES to ESPM 175. Their constant support, reassurance, and wisdom was vital in getting this project from wishful thinking to actualizing. I thank Dacher Keltner for his support in building my methods and finding my niche in the field. Thank you to all my wonderful classmates, who are among the hardest working, most driven and passionate people I know. It was an honor to work and learn among you, and I cannot wait to see all you accomplish in this world. And lastly, to my parents, my sisters, and all my homies, your constant and unconditional love and support is my lifeline, and for that I'm eternally grateful.

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