Impact of COVID on Transgender Women Health

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1 Executive Summary

This study aims to examine the impact of the COVID19 pandemic on transgender women's healthcare experiences, with a focus on their Financial Health and Gender Affirming care. The data for this study is derived from a COVID supplement to an NIH-funded study that evaluates the efficacy of a sexual health promotion intervention for transgender women. The preliminary findings indicate significant challenges faced by transgender women, including disparities in HIV infection rates, mental health issues, limited healthcare access, and negative healthcare encounters and *Socioeconomic Status* [1]. The study explores the relationships within the dataset using statistical analysis and methods such as Network Analysis and Graph Theory, aiming to identify patterns and changes that affect transgender women's access to financial and gender health. The exploratory data analysis reveals insights into demographic variables, financial status, gender affirmation, and housing transitions, highlighting the complex dynamics at play. The findings provide valuable information to better understand and address the healthcare needs of transgender women during the COVID-19 pandemic and beyond.

2 Introduction and Background

The focus of this study is to examine the potential influence of the COVID19 pandemic on transgender women's healthcare experiences, especially on their perceived access to various health services. From the client's data, key areas under consideration include:

- Mental Health: mental health care seeking during COVID.
- Physical Health and Healthcare seeking during COVID.
- Financial health during COVID: income, sex work, health insurance.
- Gender Health during COVID: changes in gender affirmation health care (seeking and access) and reported changes in gender congruence.
- Sexual activity during COVID includes amount and types of sexual activity, number of partners, and sexual health risk reduction activities.

However we will be focusing on Financial Health, and Gender Health which is also referred to as *Gender Affirming Care*. ***Gender Affirming Care*** is defined as "care that respects and validates a transgender, non-binary, or intersex person's experience. In terms of accessing transition-related treatment, gender-affirming care refers to interventions that support people in their gender transition." by CareOregon[2].

The data for this study is from a COVID supplement to an NIH-funded study to evaluate the efficacy of a sexual health promotion for transgender women in the US. In a study published 23 Dec 2019 titled "Findings from Formative Research to Develop a Strength-Based HIV Prevention and Sexual Health Promotion mHealth Intervention for Transgender Women" they mention that "Transgender populations face considerable health disadvantages, ranging from poorer mental health to barriers to care. Transgender persons have the highest HIV incidence of any subgroup ; transgender women in particular

experience significant disparities in HIV infection " [3]. The same study goes on to point out that "a growing body of literature has described the links between high HIV rates and the structural contexts of transgender lives, including gender abuse, stigma, transphobia, culturally insensitive health care and health care barriers, and employment and housing discrimination. Other prevalent health conditions among transgender women can contribute to an increase in sexual health risk, including discrimination-based physical and verbal abuse, homicide, poor mental health, alcohol and drug use, and other unmet health needs resulting from limited health care access and negative health care encounters. Thus, there is a need for prevention activities that address the social and structural factors contributing to high HIV incidence rates among transgender women" [4].
From this viewpoint, it is evident that the problem statement for the COVID supplement data study is a complex one, with many driving factors at play such as income, housing and other social determinants of health [1] all affecting the health of Trans women and society as a whole.

Given that we are interested in what role finance plays in determining the access of Trans women to healthcare, we will mention here a finding from another team's exploration of this data set which was supplied to us by the client, this analysis was done by TWC program staff.

"Changes in Finances. Annual income between baseline and the final follow-up decreased significantly (p=.002). There was a significant increase in the amount of sex in exchange for money/goods between timepoints 1 and 3 (p=.012)."

3 Goal

The primary goal of this study is to use statistical analysis and related methods, such as Network Analysis and Graph Theory, to determine and interpret the relationships that might be present within our client's COVID supplement data. We will also build and test models to look for the presence of patterns or changes that distinguish trans women's access to financial health and gender health.

4 Data Acquisition and Processing

The dataset originates from a survey administered to 592 transgender women, which started in April 2021. This survey involved various health-related questions, encompassing the domains of mental health, physical well-being, sexual activity, gender health, and financial health. The study's design involved a randomized controlled trial (RCT), examining the effectiveness of a new mobile application, the Trans Women connected (TWC) app. Data collection spanned from April 2021 to September 2022, wherein participants completed a sequence of surveys: a baseline survey, a one-month follow-up, a three-month follow-up, and a six-month follow-up. From the client, we were informed that the data collection process allowed participants the option to not answer questions they did not want

to, or felt uncomfortable answering. We were also given preliminary exploratory data analysis conducted by some other teams that had previously worked with the data set. One pattern we noticed, from that analysis, which was relevant to what we were looking into was there was a change in income from baseline and follow-up surveys meaning that people who took the survey made less money from initial to follow-up. They also found that there was a significant increase in sex work in exchange for money and goods. Which is what was also reported in Sun study when they talked about how trans women face more discrepancy in society than other subgroups [3].Because this dataset had already been investigated by other teams, we did not look at areas in the dataset which have already been examined. Basic analysis of the effectiveness of the primary intervention have been completed in addition to exploratory analysis of the impact of a COVID-mitigation intervention for transgender women.

In the preparation phase for our data analysis, we encountered a significant challenge identifying and managing missing (NA) values. However, following consultation with our client, we resolved to exclude data from participants who only completed a partial or complete initial survey and did not partake in subsequent surveys. Additionally, we discarded questions that were universally unattempted, receiving no response from any participant.

4.1 Exploratory data analysis

Prior to employing any data modeling methods, we carried out our own exploratory data analysis to delve deeper into the data and identify the presence of any patterns, trends, and possible anomalies. The examination started with a probe into the dataset's missing values. To better visualize these absent data points, a heatmap was generated, with lighter colors indicating missing values and black colors denoting areas where data was present. As illustrated in Figure 1, there is a noticeable number of missing data.
There could be several explanations for this occurrence. First, participants might have chosen not to answer certain questions if they felt uncomfortable. Second, we realized that some questions were conditional questions, which have the potential of generating missing data especially in survey data. For instance, those who haven't been vaccinated may have opted not to answer subsequent questions about covid, or those not affected by HIV could have bypassed questions pertaining to HIV. Lastly, individuals may have chosen not to disclose information about their partners' health, thus resulting in further data gaps.

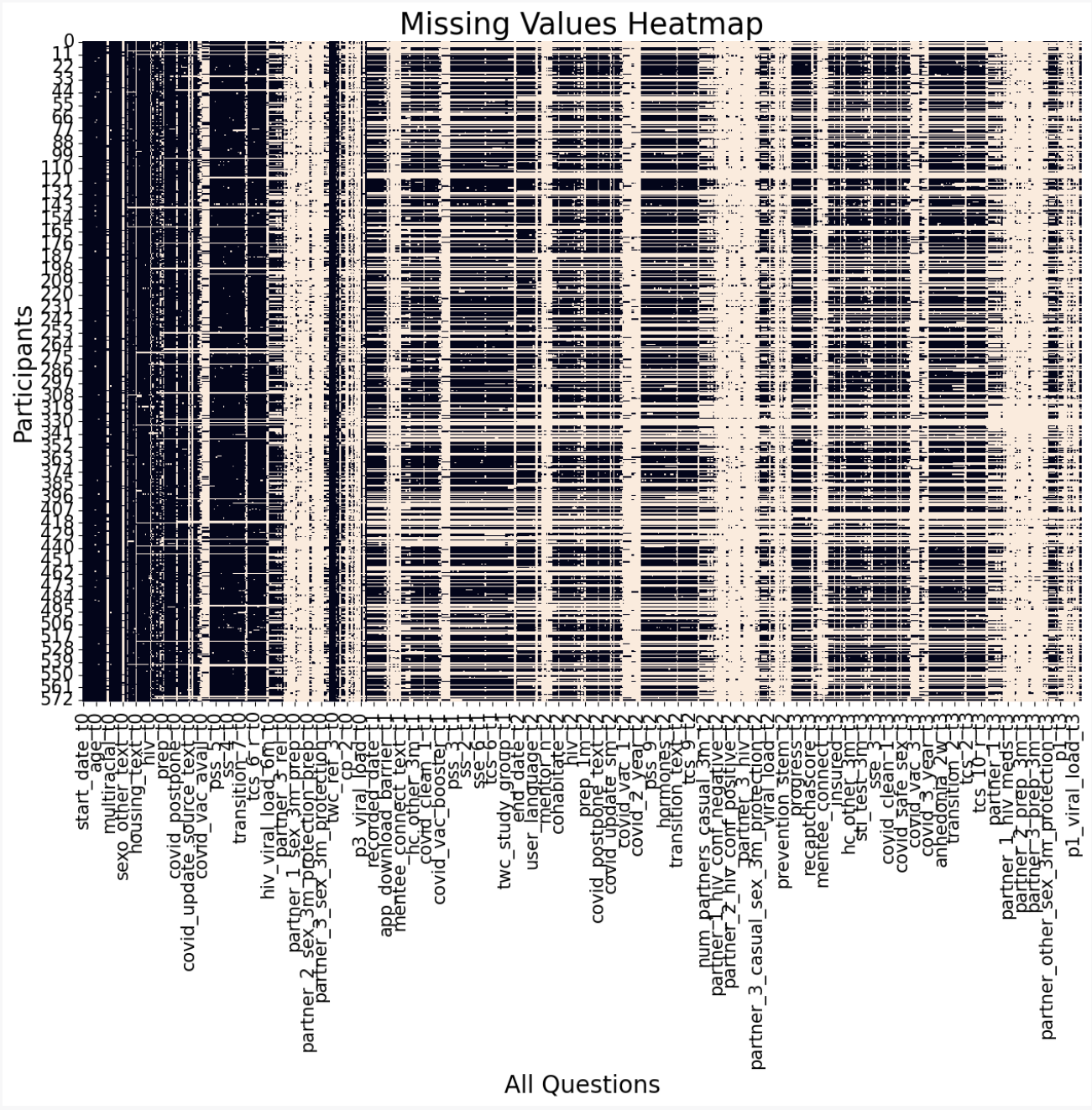

Figure 1

The EDA process was categorized into several themes, each addressing a specific aspect of the data:

4.1.1 Demographic Variables

We focused on the participants' age and racial background. From Figure 2, each bar represents a specific age and is divided into segments based on different races. Figure 2 also illustrates a preponderance of white participants. When compared with the racial distribution in Oregon, particularly Portland, our dataset seems to mirror the actual demographic context. As of 2020, the majority of Portland's residents were White (Non-Hispanic). The considerable presence of White (Non-Hispanic) participants in our data, as illustrated in Figure 2, indicates its alignment with the actual racial composition of the state, thereby lending credence to the representativeness of our dataset. [3]

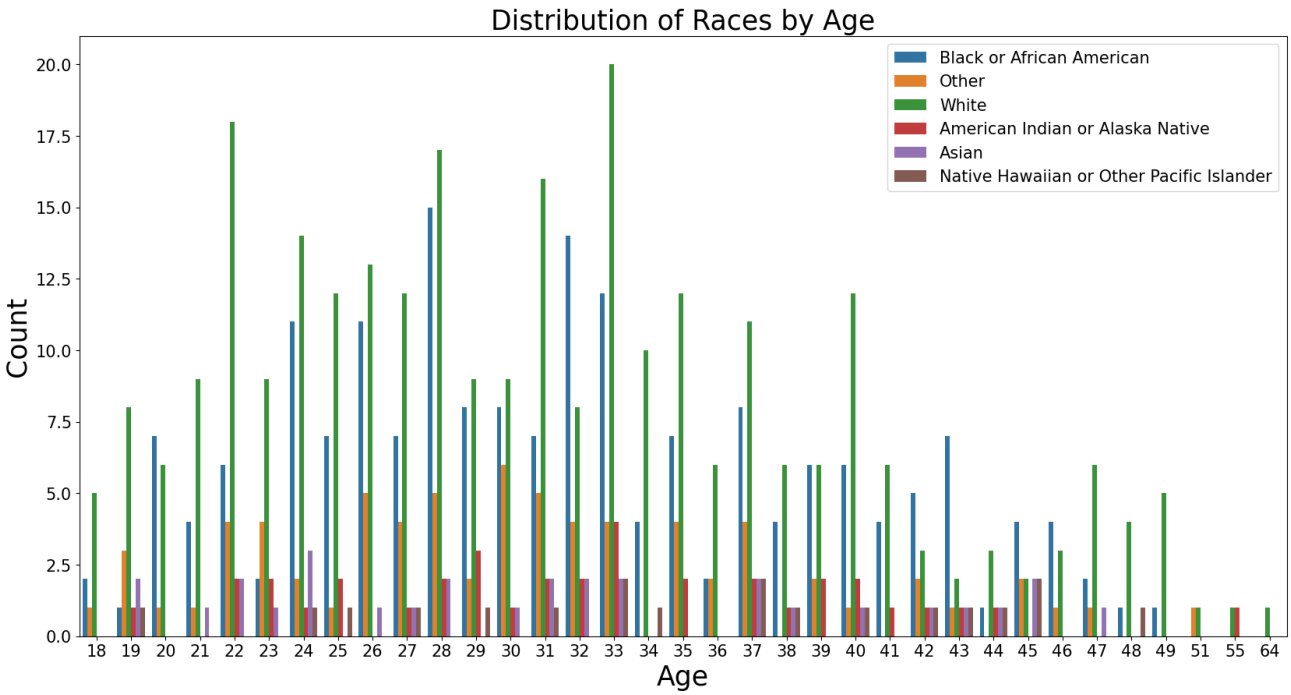

Figure 2: Participants' age and racial background

We also investigated the self-reported sexual orientation of respondents. An analysis of various sexual orientation variables yielded the count of individuals associating with each category.

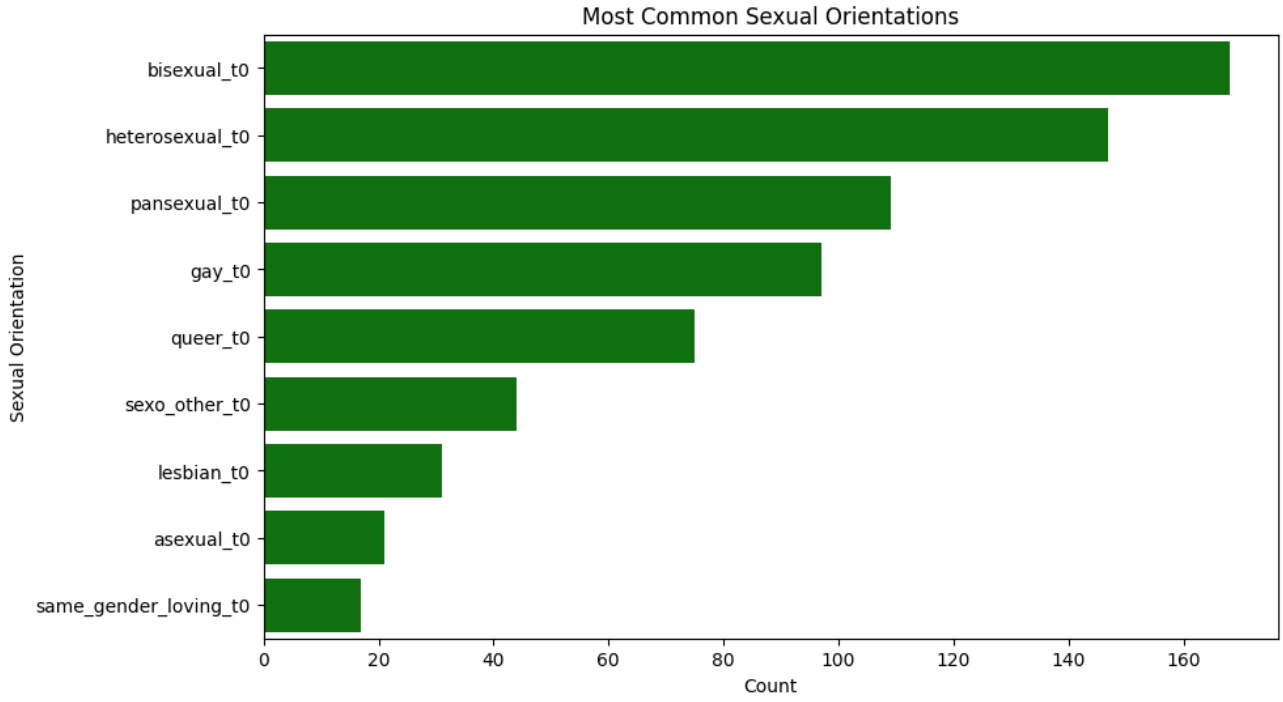

Figure 3: Self reported sexual orientation

4.1.2 Financial Status

Insurance: The change in insurance status between two time points, 't0' and 't3', was an

area of focus for us. We identified a subset of 363 participants who had data available at both time points. In order to properly handle the missing information from some participants, we opted to analyze this subset specifically. In Figure 4, a slight increase can be observed in the number of individuals with insurance coverage.
However, we exercised caution while making this decision, aware that retaining only complete responses could potentially lead to the exclusion of shared attributes of non-respondents that could be pivotal in explaining the observed patterns. Consequently, this might lead to a biased sample.
In response to this concern, we undertook a comprehensive review following the removal of participants whose data was incomplete. Our aim was to validate that the subsequent subset remained unbiased and adequately represented the broader population. During this re-evaluation of demographic variables, it emerged that participants aged 49 and above had been excluded from our analysis. However, despite this, our validation assured us that the final sample still maintained a fair demographic representation.

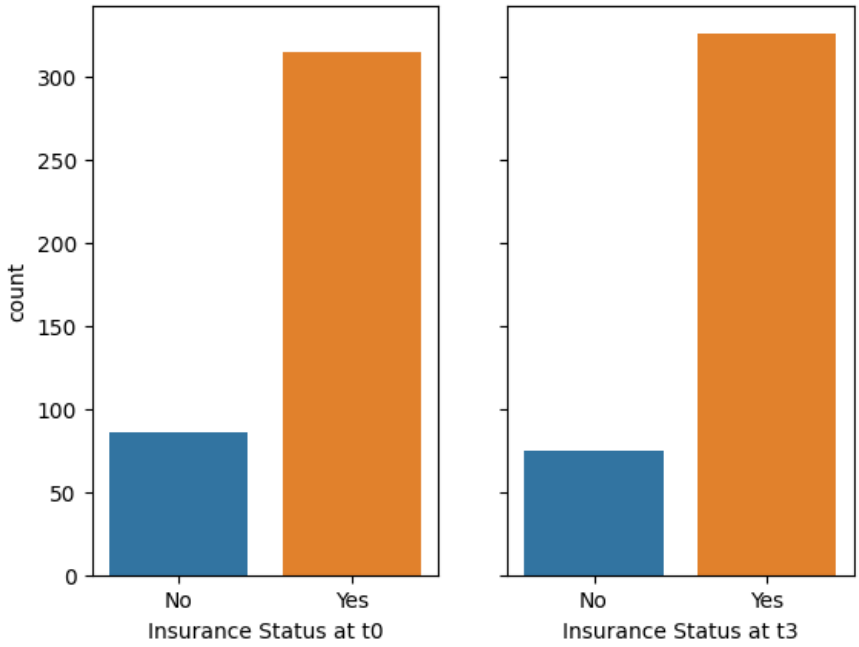

Figure 4: Change in insurance status between two time points, 't0' and 't3'

Income: The transition of income between the time points 't0' and 't3' is depicted in the following Sankey diagram. As a specific type of flow diagram, a Sankey diagram visualizes the progression of variables, with the width of its arrows reflecting the flow's magnitude.
Observations extracted from Figure 5 include:

- Stability of income was noted for 190 respondents throughout the observed interval.
- An income surge, reflected in their progression from the first to the subsequent categories, was observed for 95 respondents.
- On the other hand, a downward income trend was observed for 53 individuals.
- Regrettably, income transition data for the remaining respondents was unavailable.

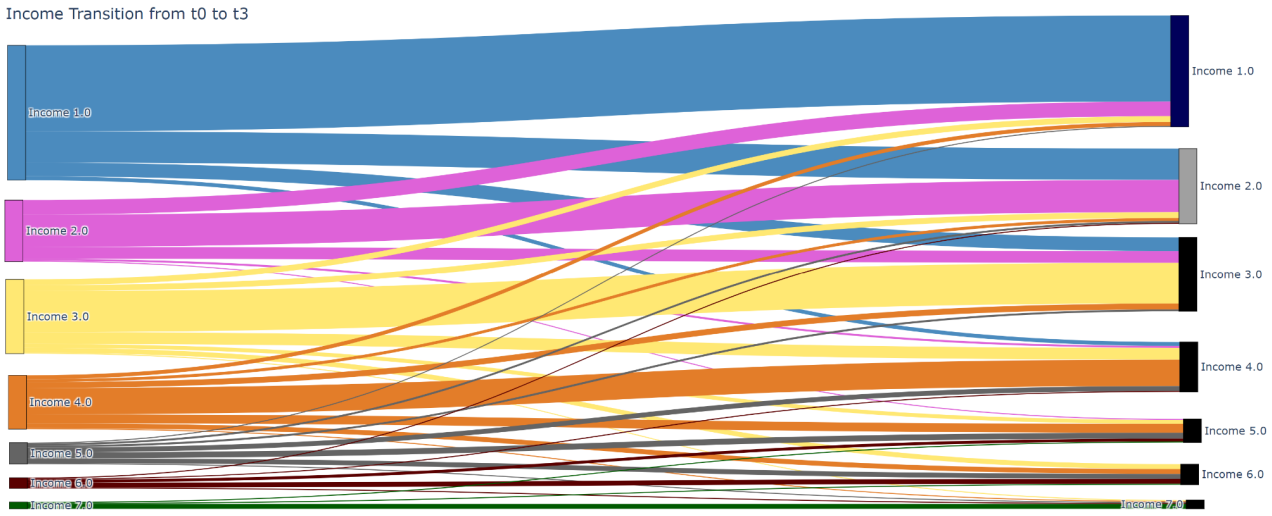

Figure 5: Income transition from T0 to T3

Moreover, we computed the average change in the income category for those who witnessed an increase or decrease in income. Our computations revealed that, on average, the individuals who experienced an income increase observed a rise of approximately 1.5 units in their income category. Similarly, those who encountered a decrease in income faced an average reduction of approximately 1.5 units in their income category. These results suggest a consistent average change in the income category in both scenarios.

In assessing income changes, employment status naturally comes to the fore as a key influencing factor. We decided to scrutinize the correlation between alterations in employment status and income by creating a box plot (Figure 6). This graphic representation facilitates the understanding of how income transitions correlate with different employment status changes. The count of individuals experiencing each type of work status change is also indicated as "n". From the plot, it is noticeable that 41 participants ceased their employment. Intriguingly, despite this shift in employment status, a subset of these participants reported an elevation in their income.

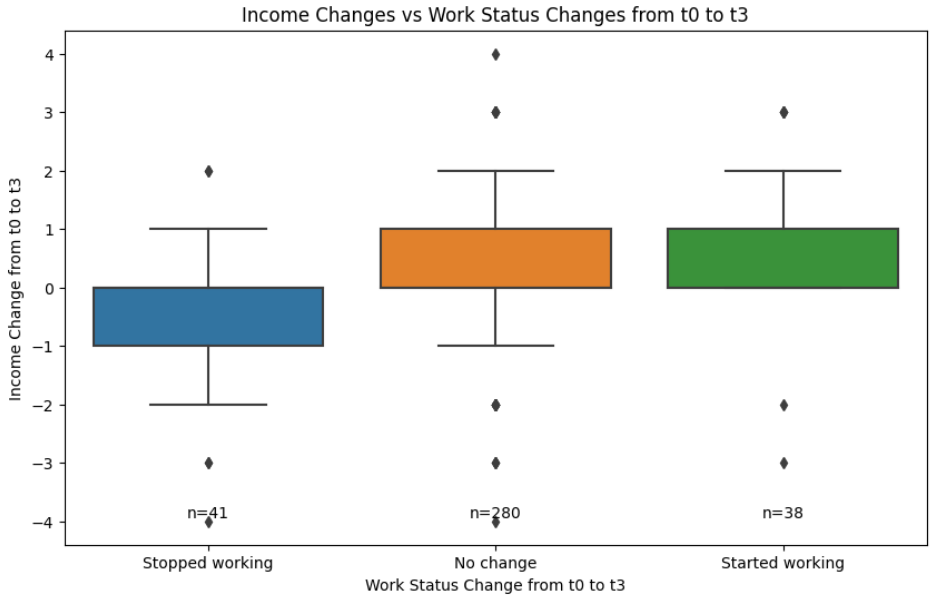

Figure 6: Income changes vs work status changes

Housing: Naturally, following employment and income, considerations of housing transitions come to the forefront. To examine these shifts, we filled any missing data or NaN values with the string 'No data'. This approach guaranteed that every entry had a corresponding value, thereby preventing any reduction in respondent count due to missing information.

Figure 7 offers a visual depiction of the housing transitions noted during the COVID period. A closer look reveals that several individuals underwent changes in their housing situations. For example, individuals formerly residing in rented houses or apartments (blue color arrow) may have relocated to stay with friends and family or transitioned to public housing. This visualization provides an insight into how housing stability was affected during the period under review.

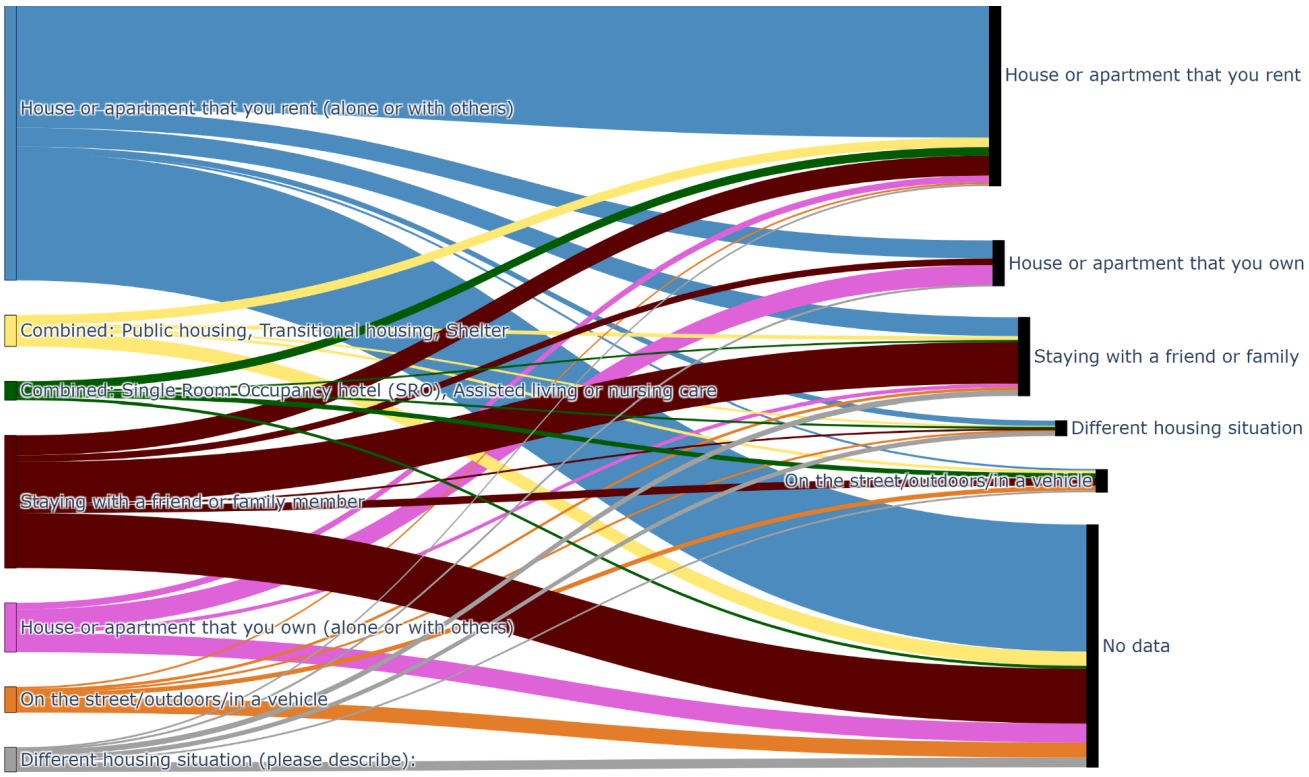

Figure 7: Housing Transition from T0 to T3

4.1.3 Gender Affirmation

Our exploratory data analysis also encompassed variables related to gender affirmation. The objective of this analysis was to monitor the hormone usage changes among participants from the baseline (t0), through the second time point (t2), and eventually to the third time point (t3). Initially, we addressed any missing values by substituting NaN entries with 'No data'. We employed a *Sankey* diagram to visualize these transitions, which unveiled several patterns:

- Continuity in hormone usage from t0 to t2 was observed for 132 participants.
- Interestingly, 56 participants initiated hormone usage by t2 despite not using them at t0.

- Contrarily, 33 participants ceased hormone usage by t2, despite using them at t0.
- Additionally, 74 participants refrained from hormone usage at both t0 and t2.
- For the remaining participants, the data was unfortunately unavailable.

Between t2 and t3, similar patterns of transitions were observed. This analysis, therefore, sheds light on the variations in hormone usage among the study participants over the defined period.

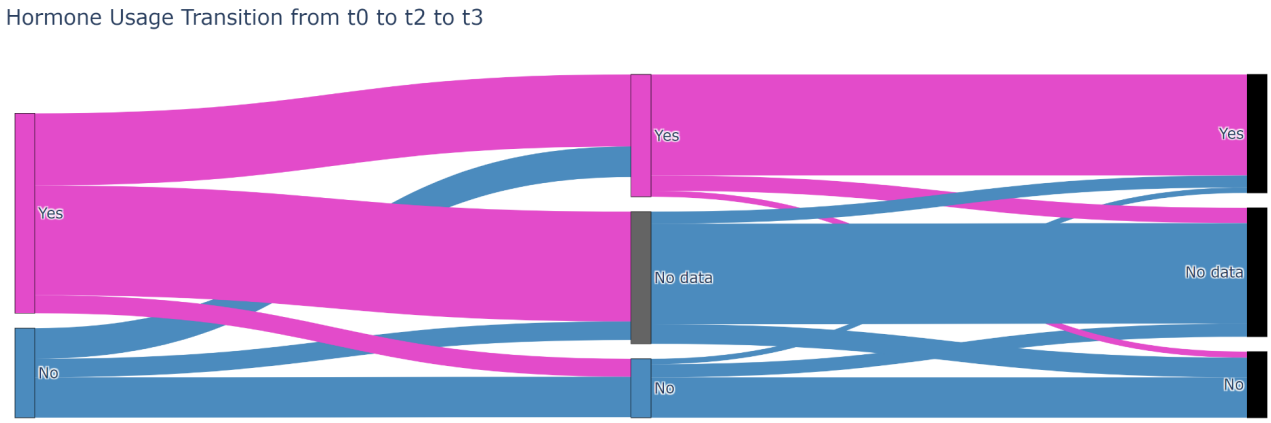

Figure 9: Hormone usage changes from T0 - T3

Figure 9 illustrates the fluctuations in hormone usage among study participants over time. Intriguingly, we pondered whether income could influence hormone intake during this period. To explore this potential correlation, we produced a heatmap, as seen in Figure 10.

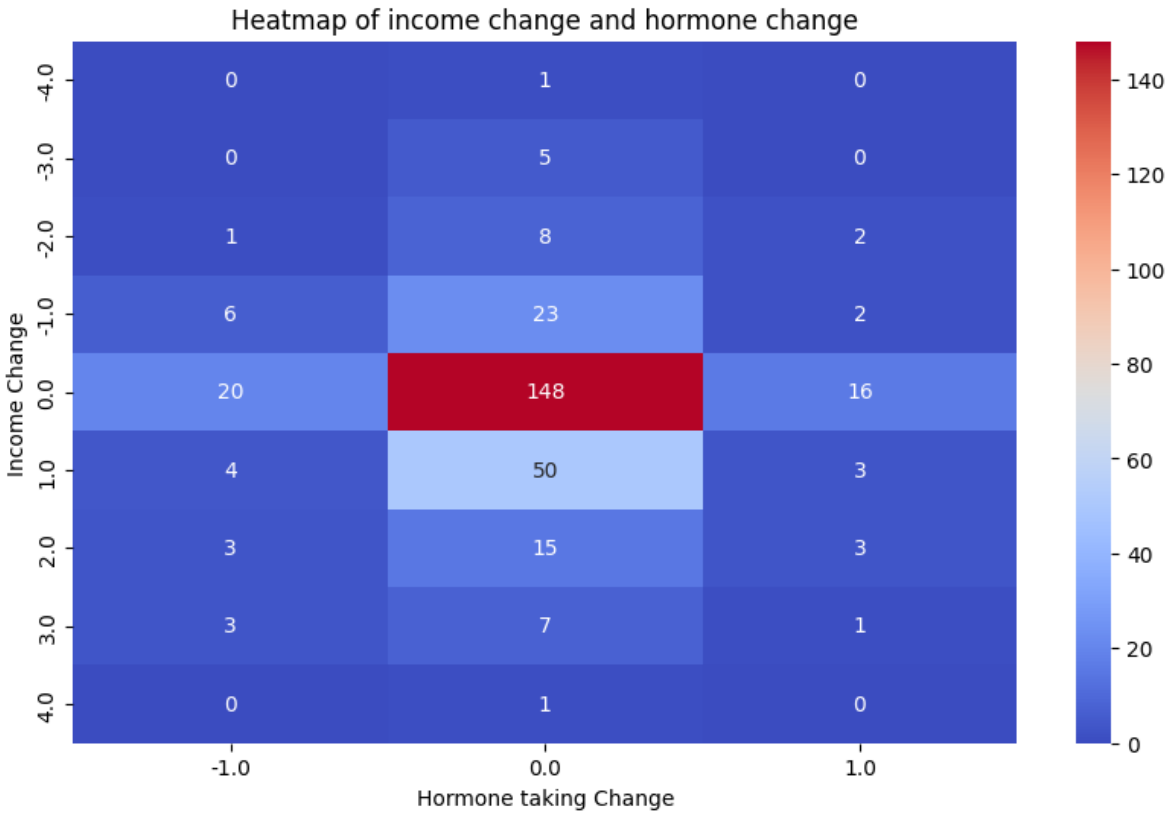

Figure 10: Heatmap of relationship between Hormone usage and income change

However, upon examination, we found no clear relationship between hormone usage and income levels.To confirm this finding, we executed a chi-square test of independence. This test is used to determine whether a statistically significant relationship exists between two nominal, or categorical, variables. It involves comparing the distribution frequencies of each category for one nominal variable to the categories of the second nominal variable. We got the p-value of 0.797 for the chi-square test.

From these results, we can't reject the null hypothesis at the 0.05 significance level. This suggests that the test didn't find a statistically significant association between changes in hormone usage and income from t0 to t3 in our dataset.
We carried out a similar test for the "Income" and "Hormone Taking" categories, as displayed in Figure 11 in appendix. The results did not reveal a statistically significant relationship between insurance and hormone usage at the 0.05 level ($p = 0.878$) from t0 to t3.

We endeavored to illustrate the progression of participant responses relating to various gender transition procedures across three distinct time points t0, t2, and t3. The procedures under examination ranged from 'Hair Removal', 'Breast Augmentation', 'Silicone Injections', 'Orchidectomy', 'Vaginoplasty/labiaplasty', to 'Voice Therapy non-surgical and surgical'. The participant's responses to these procedures were segmented into four categories: 'Have had this', 'Want it someday', 'Do not want this', and 'Not sure if I want this'. We chose to utilize a two-dimensional matrix of pie charts to represent each transition procedure at every time point effectively.

For instance from Figure 12, considering 'Hair Removal', at t0, 38.5% of participants

reported having undergone this procedure, while 51.8% expressed a desire to have it someday. A small portion of 4.3% did not want it, and the remainder was uncertain. By t2, the proportion of participants who had undergone this procedure had increased to 41.7%, while 47.1% still expressed a desire for it in the future. 4.9% did not want it, and the rest were either unsure or did not provide data, and so forth.

Figure 12: Pie chart showing gender transition procedures across three distinct time points

While analyzing the data, it is vital to mention that we retained only the participants who completed all three surveys. Despite this, we revisited the demographic variables to confirm that our resultant subset was not skewed and continued to represent the larger population accurately. This step validated that our final sample maintained a fair representation across the demographic variables, thereby preserving the integrity and robustness of our conclusions.

We were particularly interested in exploring the shifts in participant responses to various aspects of gender identity over four distinct time points. Each facet of gender identity was articulated through a statement such as 'Appearance represents Gender Identity', 'Experience sense of unity between gender identity and body', and 'Physical appearance expresses gender identity', among others. Participants reacted to these assertions on a scale ranging from 1 to 5, where 1 denoted 'Strongly disagree' and 5 signified 'Strongly agree'. For our analysis, we computed the average response for each statement at every time point and graphed these average responses over time. Our primary objective was to identify any discernible trends or fluctuations in average attitudes pertaining to these aspects of gender identity.

Figure 13, displays each gender identity-related statement through a unique line. Upon examining the plot, we were able to discern trends and transformations in the participants' attitudes towards their gender identity over the duration of the study. For instance, an upward trajectory in the line representing a statement implies that respondents increasingly concur with that statement over time. Conversely, a downward trend suggests growing disagreement with the statement over time. A flat line suggests a stable perspective towards the statement, indicating minimal change in attitudes over the observed period.

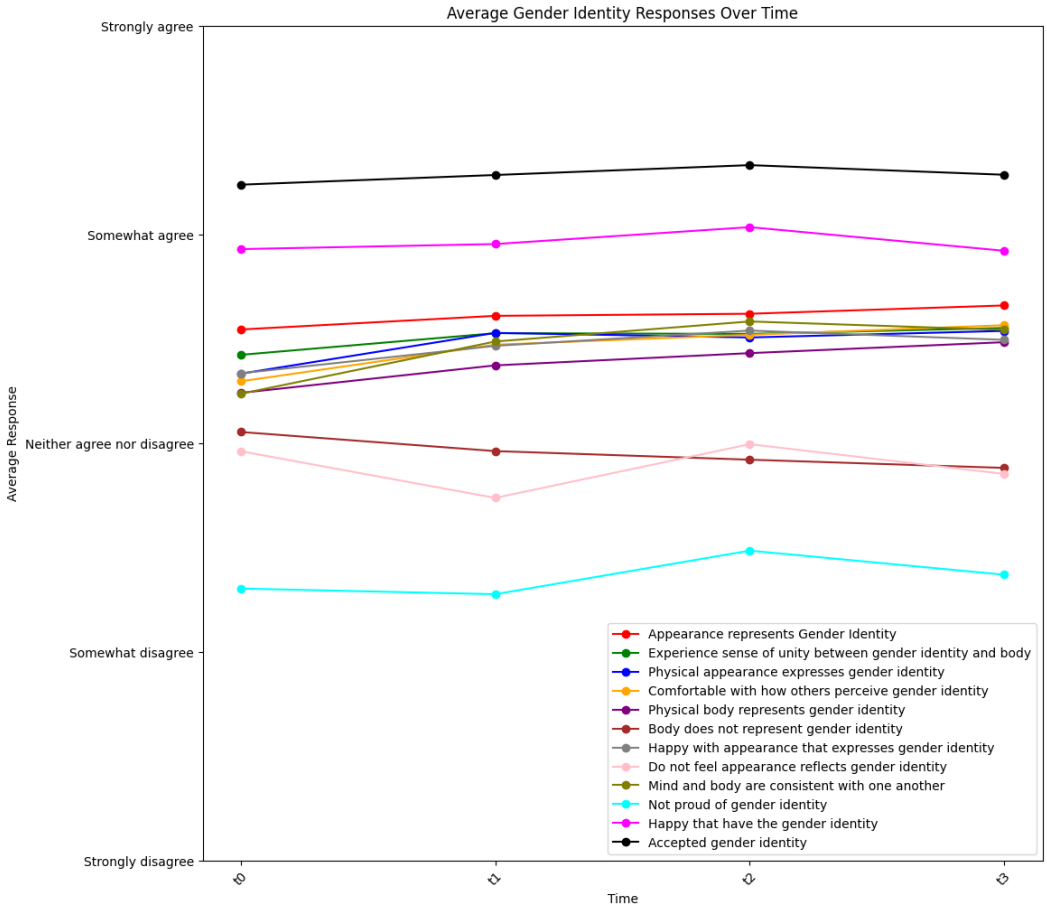

Figure 13: Average gender identity responses over time

Subsequently, we executed a chi-square test of independence to examine the potential association between responses related to gender identity and those pertaining to gender transition. Given our results with a p-value of 0.00, we rejected the null hypothesis at the 0.05 significance level. This suggests robust evidence supporting the existence of a relationship between the responses on gender identity and gender transition. In essence, we observed a statistically significant correlation between attitudes towards gender identity and responses to gender transition procedures.

To further illustrate this, we constructed a contingency table showing the frequency distribution of responses to both the gender identity and gender transition statements. The table, presented in Figure 14, delineates the count of respondents for each category (ranging from 'Strongly disagree' to 'Strongly agree') corresponding to each possible transition state (such as 'Do not want this', 'Have had this', and so on).

For example, the figure at the junction of 'Strongly disagree' and 'Do not want this' (237) implies that 237 respondents expressed strong disagreement with a given statement about gender identity, and concurrently responded that they did not desire a specific aspect of gender transition.

```
Contingency Table:
col_0                        Do not want this  Have had this  \
row_0
Strongly disagree                         237             77
Somewhat disagree                         173             77
Neither agree nor disagree                171             81
Somewhat agree                            260            176
Strongly agree                            232            213

col_0                        Not sure if I want this  Want it some day
row_0
Strongly disagree                                211                347
Somewhat disagree                                209                381
Neither agree nor disagree                       200                392
Somewhat agree                                   340                582
Strongly agree                                   214                478

Chi-square test of independence:
Chi-square value: 95.45377228008336
P-value: 4.305685807833209e-15
```

Figure 14: Output of a chi-square test between gender identity and gender transition

4.1.4 Mental Health

The impact of the COVID-19 pandemic on mental health continues to be a pressing issue three years after its onset, with 90% of U.S. adults acknowledging the country's ongoing mental health crisis as per a recent KFF/CNN survey. [7] The multifaceted influence of the pandemic on the population's mental well-being, including factors such as social isolation, job loss, financial instability, and the experience of illness and grief, urged us to examine mental health-related variables closely. We visualized the frequency of visits made by participants to mental health professionals such as psychiatrists, psychologists, social workers, or MFTs over time. As depicted in Figure 15 There is an upward trend in the number of these visits in the second and third survey, followed by a decrease by the last survey.

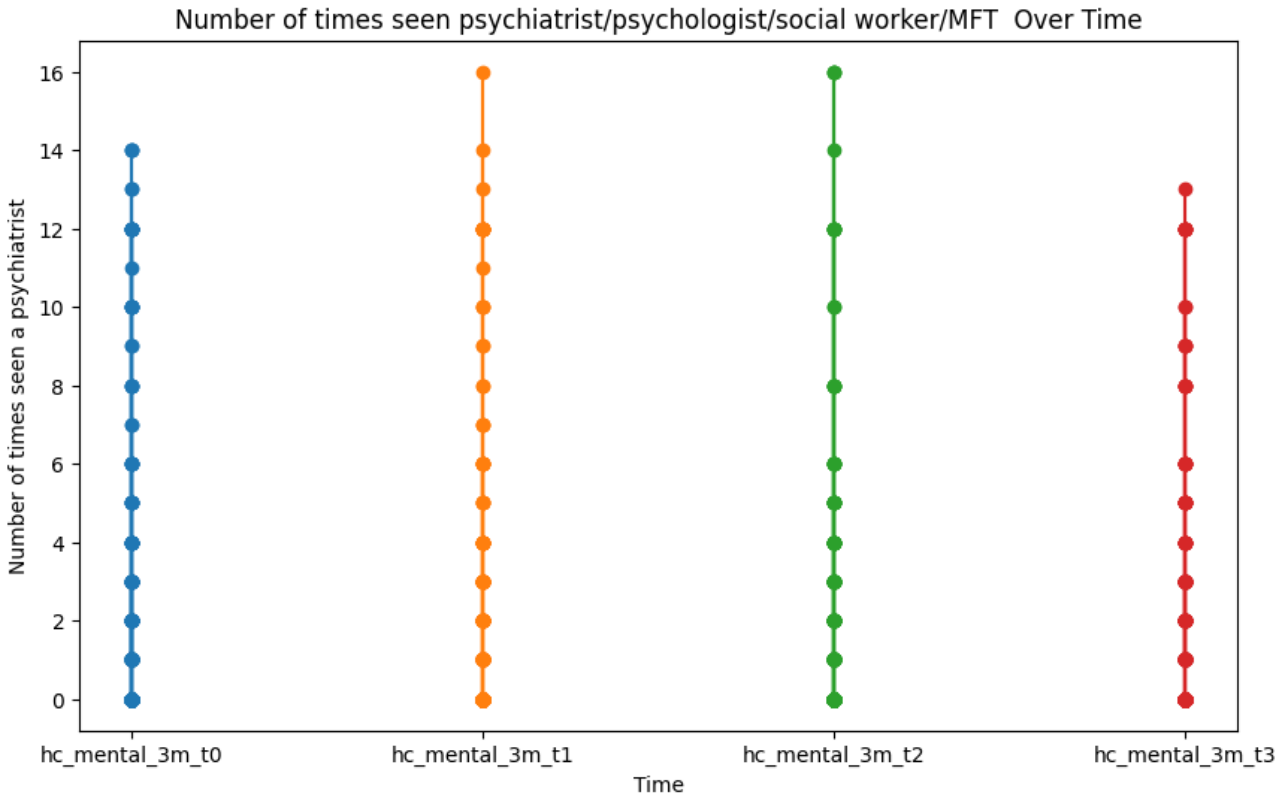

Figure 15: Number of times participant seen psychiatrists/psychologists over time

5 Method

5.1 Introduction to Network Analysis and Graph Theory

We are using network analysis and Leiden clustering to detect communities. Then we used a chi-square test to check if there is any association between demographics and communities.

The methodology employed in this project is grounded in network analysis, specifically tailored for network coincidence analysis. From Escobar, Barrios, Prieto, and Martinez-Uribe, 2020, *network coincidence analysis* is a powerful tool used for exploring patterns of co-occurrence among interconnected survey question/response combinations [5]. Here, graph theory, the mathematical foundation of network analysis, plays a vital role in the understanding of this methodology.

A *graph* refers to a network of nodes and edges rather than a chart or plot. Nodes in the graph represent specific question/response combinations, and edges represent the degree of coincidence, or co-occurrence, between these combinations. The network analysis approach will allow us to visually and analytically explore the interplay between and within the patterns of responses, with the goal of extracting overarching trends or themes.

5.2 Network Analysis Methodology

5.2.1 Introduction to netCoin

The R package `netCoin`, which is designed to conduct network coincidence analysis [5], is able to identify co-occurrence (coincidences) patterns among specific question/response combinations across the dataset, defining these patterns as *scenarios*.[5]

5.2.2 Theoretical Foundation of Coincidence Analysis

Coincidence analysis operates within the framework of graph theory, where a node (question/response combination) represents a potential outcome. The complexity of the dataset results in a diverse range of scenarios involving various combinations of responses. A question/response combination is considered *coincident* with another if they often occur together in the data. Coincidences can be classified into several types, and their frequencies measured using binary proximity metrics. [5]

5.2.3 Structure and Analysis of Incidence and Coincidence Matrices

The set of question/response combinations can be represented using an incidence matrix, with one dimension (typically the rows) representing the scenarios and another dimension (typically the columns) representing the combinations. The incidence matrix is used to calculate the coincidence matrix. Binary proximity metrics derived from the coincidence matrix enable the calculation of frequencies of the four states of presence/absence of two question/response combinations within the studied scenarios. [5]

5.2.4 Adjacency Matrix

The binary proximity metrics can be converted into an adjacency matrix, a square matrix representing the number of coincidences between each pair of question/response combinations. This conversion enables easier assessment of response relationships, which can be further visualized using a graph. [5]

5.2.5 Graph Visualization: Nodes, Edges, and Layouts

The graph comprised nodes(question/response combinations) and edges(coincidences), connecting pairs of nodes. The spatial distribution of nodes presents a challenge addressed in netCoin using a dynamic Fruchterman-Reingold algorithm. [5]

5.2.6 Community Detection and Modularity

Community detection algorithms, such as the Leiden algorithm, assess the clustering of

nodes and their tendency to consolidate or separate. The Leiden algorithm identifies communities in large networks by maximizing a modularity score for each community, representing dense inter-node connectivity within the same community relative to a random network. Modularity quantifies the division within a network into distinct communities or modules. [6]

6 Results

The survey questions are coded as q1, q2... q35. The responses are coded on a scale of 1-5, where 1 represents "strongly disagree" or "never," and 5 represents "strongly agree" or "always." The corresponding mapping can be found in Table 1.1 and Table 1.2, located in the Appendix. In the network analysis model, an event is defined as a combination of a question and its corresponding response, such as q1:1. An event occurs when a participant responds with a 1 for question q1. A scenario is then defined as a set of these events.

For each survey, we selected the month and year combination with the highest number of respondents. We then chose a three-month period close to that month and year. Consequently, we obtained 457, 258, and 356 records for the first, second, and fourth surveys, respectively.

To generate the adjacency matrix and network graph (refer to Fig 13 and Fig 14), we utilized the "surcoin" function from the netCoin package. Each node in the graph represents a survey question, and an edge between two nodes indicates a close relationship between the responses to those questions.

To identify the community of respondents, our next step was to perform Leiden clustering. The Leiden clustering algorithm divides the network into four distinct communities or clusters (refer to Fig 15.1, Fig 15.2, and Fig 15.3). Modularity for Survey 1, 2 and 4 is 0.011, 0.014, and 0.014 respectively.

In Survey 4, cluster 4 consists of events where respondents indicated having consistent support when they were sick or feeling depressed, as well as events where they reported frequent feelings of upset when expected situations occurred (refer to Table 3). In Survey 1, cluster 4 is a larger group compared to Survey 1, encompassing events where respondents mentioned being frequently irritated and struggling to control their actions in life. Additionally, the community/cluster 4 in Survey 1 includes events where respondents somewhat agreed with most of the gender affirmation questions (refer to Table 3).

For Survey1 and Survey4, Table 2.1, Table 2.2, and Table 2.3 display the demographic distribution of respondents within clusters. We observed that most of the white women belonged to cluster 4 for survey 1. However, for survey 4, a majority of the white women shifted to cluster 3(refer to Table 2.1).

We assigned the clusters to each respondent using map_dfc function in R and conducted a chi-square test to investigate the potential relationship between demographics and communities.

For the first hypothesis:
Null Hypothesis (H0): There is no significant association between communities and race.
Alternative Hypothesis (H1): There is a statistically significant association between communities and race.

Based on the p-values obtained, the results are as follows:

Survey 1: The p-value is 0.01772. Consequently, we reject the null hypothesis at a significance level of 5%.
Survey 4: The p-value is 0.229. Therefore, we fail to reject the null hypothesis at the same significance level.

Regarding the second hypothesis:
Ho: There is no significant association between communities and ethnicity (Hispanic/non-Hispanic).
H1: There is a statistically significant association between communities and ethnicity.

The respective p-values are:
Survey 1: The p-value is 0.03627. Hence, we reject the null hypothesis at a 5% significance level.
Survey 4: The p-value is 0.059. Consequently, we fail to reject the null hypothesis at the same significance level for survey 4.

7 Recommendations and Conclusions

7.1 Conclusions

Survey Timing Impact: The start and end of the surveys spanned over a significant duration of ten months, with the first participants starting as early as April 2021 and the last participants starting as late as February 2022. Although this timeline captures a broad overview of transgender women during the pandemic, it introduces a degree of variability that might obscure the specific impacts of individual events or circumstances on the participants' experiences.

Value of Exploratory Data Analysis: The use of exploratory data analysis in this study has provided insights into the changing experiences of participants over time. This approach has shown its utility in visualizing the complex ways in which the pandemic has influenced different aspects of participants' lives.

Potential of Network Analysis: Network analysis emerged as a promising tool in understanding the interconnectedness of different survey questions. By analyzing how responses to various survey questions relate to each other, and how these networks evolve from survey to survey, we can gain a richer understanding of the complex dynamics at play in the experiences of transgender women during the pandemic.

7.2 Recommendations

In order to capture a more precise snapshot of the experiences and impacts of societal events on participants, future surveys should aim to initiate data collection for all participants within a more narrow timeframe. This can help reduce potential disparities in starting points and provide a more homogeneous foundation for analysis.

We also recommend expanding the application of network analysis. Given the time constraints for this study, we were not able to explore this avenue as thoroughly as we would have liked. However, our preliminary investigations suggest that this is a promising method for identifying connections between the various facets of the survey questions.

7 References

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7 Appendix

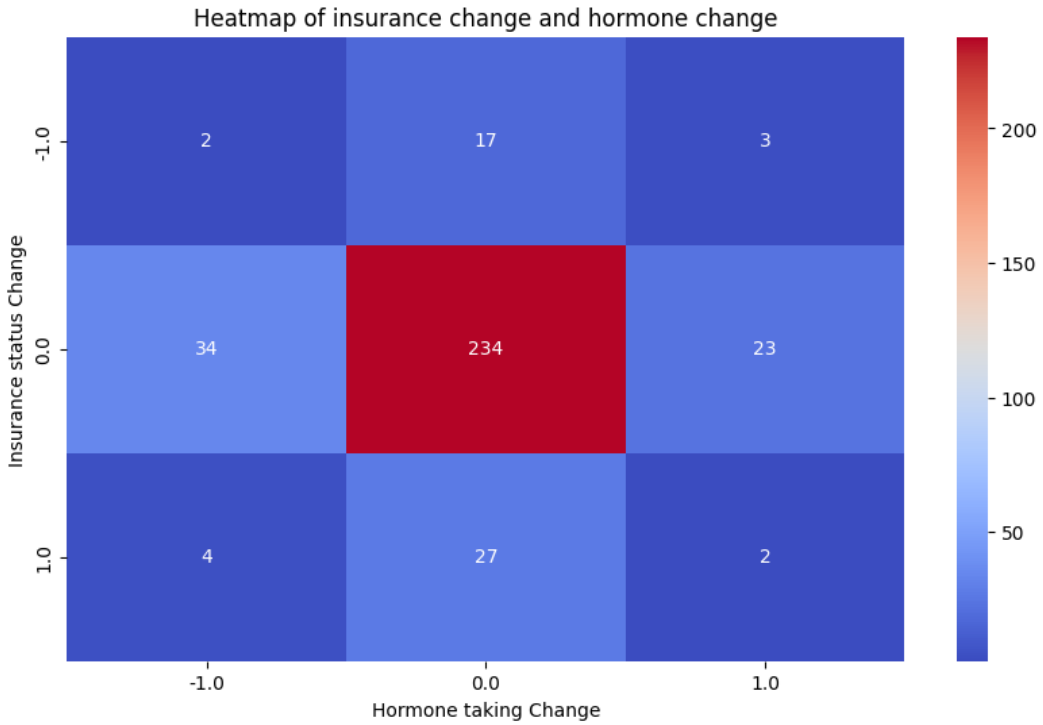

Figure 11: Heatmap of relationship between Hormone usage and insurance change

Figure 12: gender transition procedures across three distinct time point

283 scenarios and 185 events

q1:1	q1:2	q1:3	q1:4	q2:1	q2:2	q2:3	q2:4	q3:1	q3:2
0.10247350	0.11307420	0.30388693	0.46643110	0.08127208	0.15901060	0.33568905	0.40989399	0.06713781	0.10600707
q3:3	q3:4	q4:1	q4:2	q4:3	q4:4	q5:1	q5:2	q5:3	q5:4
0.28621908	0.52650177	0.12014134	0.13427562	0.34628975	0.38162544	0.11307420	0.17314488	0.32862191	0.37455830
q6:1	q6:2	q6:3	q6:4	q6:5	qr6:1	qr6:2	qr6:3	qr6:4	qr6:5
0.03886926	0.09893993	0.37455830	0.28268551	0.19081272	0.08127208	0.15547703	0.44876325	0.19434629	0.10954064
q7:1	q7:2	q7:3	q7:4	q7:5	q8:1	q8:2	q8:3	q8:4	q8:5
0.13780919	0.20848057	0.34982332	0.19787986	0.08833922	0.16961131	0.18021201	0.30742049	0.21908127	0.11307420
qr8:1	qr8:2	qr8:3	qr8:4	qr8:5	q9:1	q9:2	q9:3	q9:4	q9:5
0.04946996	0.13074205	0.32862191	0.29681979	0.17667845	0.04946996	0.13427562	0.33215548	0.25088339	0.22261484
q10:1	q10:2	q10:3	q10:4	q10:5	qr10:1	qr10:2	qr10:3	qr10:4	qr10:5
0.04593640	0.19081272	0.32862191	0.24381625	0.17667845	0.05653710	0.16607774	0.41696113	0.20494700	0.14134276
q11:1	q11:2	q11:3	q11:4	q11:5	q12:1	q12:2	q12:3	q12:4	q12:5
0.09540636	0.20141343	0.37809187	0.18727915	0.12014134	0.06007067	0.15194346	0.44169611	0.18374558	0.14134276
q13:1	q13:2	q13:3	q13:4	q13:5	q14:1	q14:2	q14:3	q14:4	q14:5
0.18021201	0.28621908	0.28975265	0.13780919	0.08833922	0.17314488	0.26148410	0.31802120	0.09893993	0.12014134
q15:1	q15:2	q15:3	q15:4	q15:5	q16:1	q16:2	q16:3	q16:4	q16:5
0.15194346	0.19434629	0.21201413	0.24734982	0.18021201	0.15194346	0.16254417	0.20141343	0.26501767	0.19787986
q17:1	q17:2	q17:3	q17:4	q17:5	q18:1	q18:2	q18:3	q18:4	q18:5
0.14134276	0.16961131	0.24734982	0.26501767	0.16254417	0.12014134	0.14134276	0.25795053	0.27208481	0.18727915
q19:1	q19:2	q19:3	q19:4	q19:5	q20:1	q20:2	q20:3	q20:4	q20:5
0.12367491	0.20141343	0.21201413	0.25088339	0.19434629	0.18374558	0.19434629	0.18021201	0.25088339	0.16961131
q21:1	q21:2	q21:3	q21:4	q21:5	q22:1	q22:2	q22:3	q22:4	q22:5
0.09893993	0.13780919	0.12367491	0.30388693	0.31448763	0.07420495	0.18374558	0.16254417	0.31095406	0.24028269
q23:1	q23:2	q23:3	q23:4	q23:5	q24:1	q24:2	q24:3	q24:4	q24:5
0.09187279	0.17314488	0.16254417	0.29681979	0.24028269	0.09540636	0.16254417	0.17314488	0.30035336	0.24028269
q25:1	q25:2	q25:3	q25:4	q25:5	q26:1	q26:2	q26:3	q26:4	q26:5
0.13780919	0.14487633	0.16961131	0.29328622	0.22614841	0.18021201	0.17667845	0.15547703	0.28268551	0.17314488
q27:1	q27:2	q27:3	q27:4	q27:5	q28:1	q28:2	q28:3	q28:4	q28:5
0.17314488	0.28268551	0.15547703	0.17667845	0.18021201	0.11307420	0.18374558	0.14134276	0.28268551	0.25088339
q29:1	q29:2	q29:3	q29:4	q29:5	q30:1	q30:2	q30:3	q30:4	q30:5
0.21908127	0.21908127	0.19787986	0.21201413	0.12014134	0.12014134	0.21201413	0.19787986	0.21908127	0.21908127
q31:1	q31:2	q31:3	q31:4	q31:5	q32:1	q32:2	q32:3	q32:4	q32:5
0.10954064	0.13780919	0.18727915	0.32862191	0.20848057	0.38869258	0.17314488	0.20494700	0.10600707	0.09893993
q33:1	q33:2	q33:3	q33:4	q33:5	q34:1	q34:2	q34:3	q34:4	q34:5
0.09893993	0.10600707	0.20494700	0.17314488	0.38869258	0.04946996	0.07067138	0.20494700	0.22968198	0.42049470
q35:1	q35:2	q35:3	q35:4	q35:5					
0.02473498	0.03533569	0.11660777	0.24734982	0.55477032					

Figure 13: Adjacency matrix for Survey 2

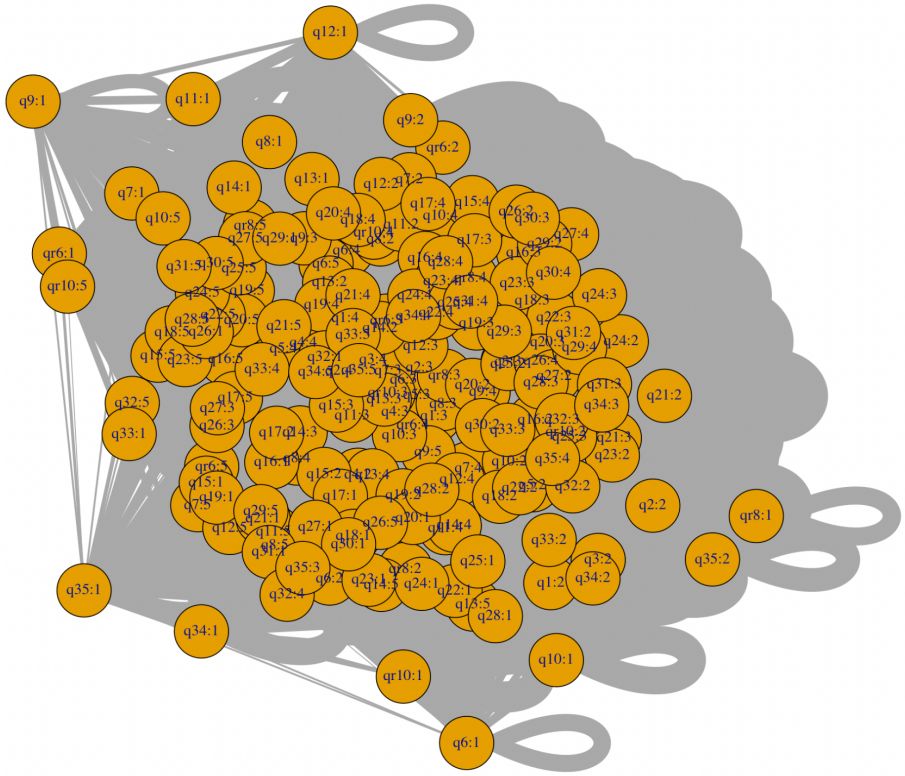

Figure 14: Network plot for Survey 1

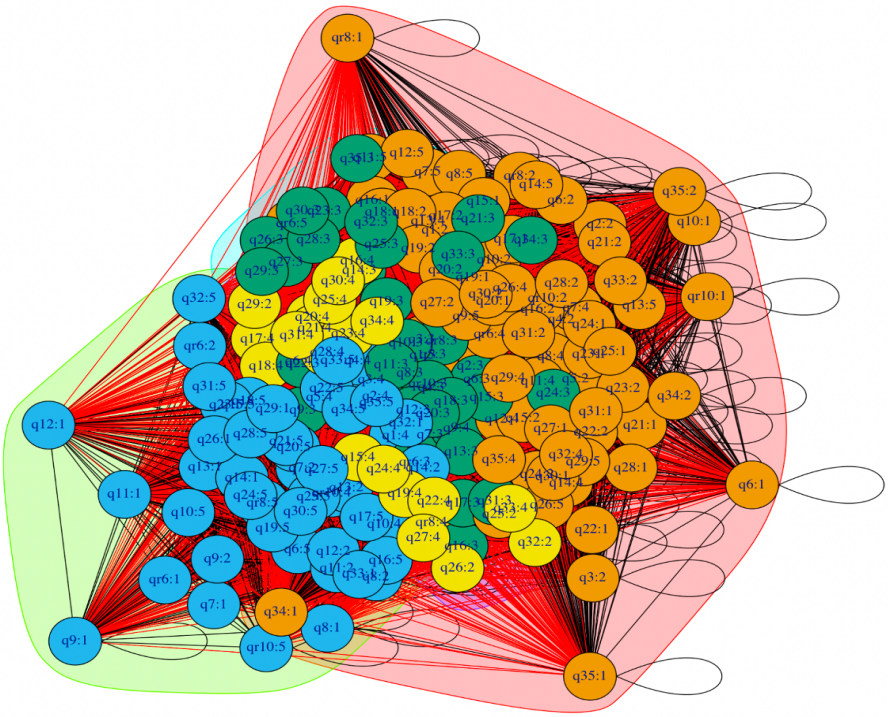

Figure 15.1 : Leiden clusterin for Survey 1

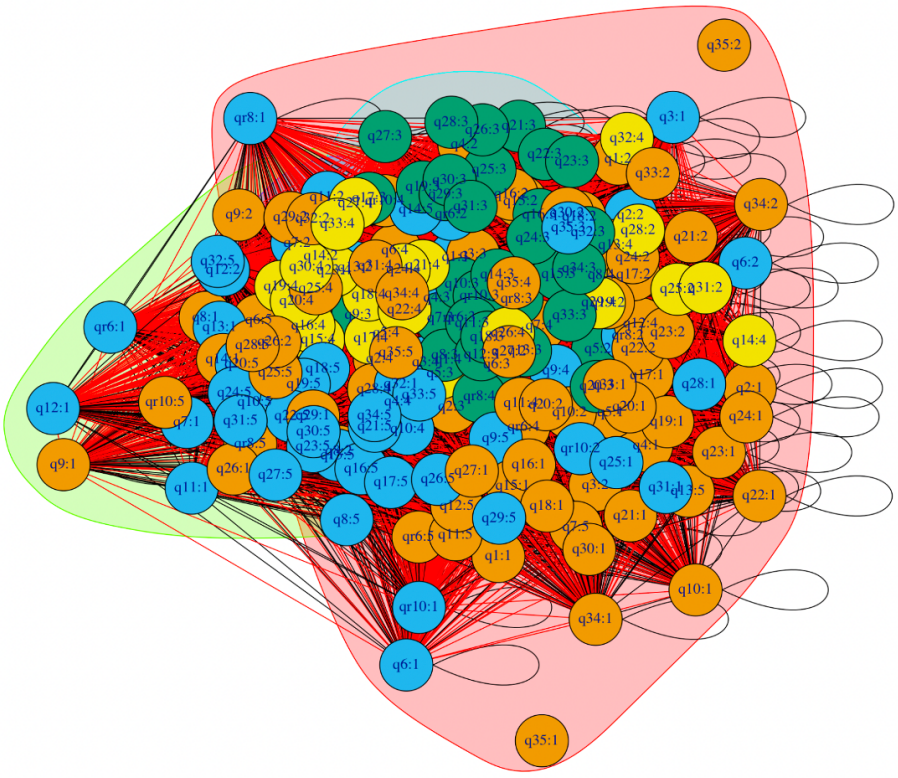

Figure 15.2 : Leiden clusterin for Survey 2

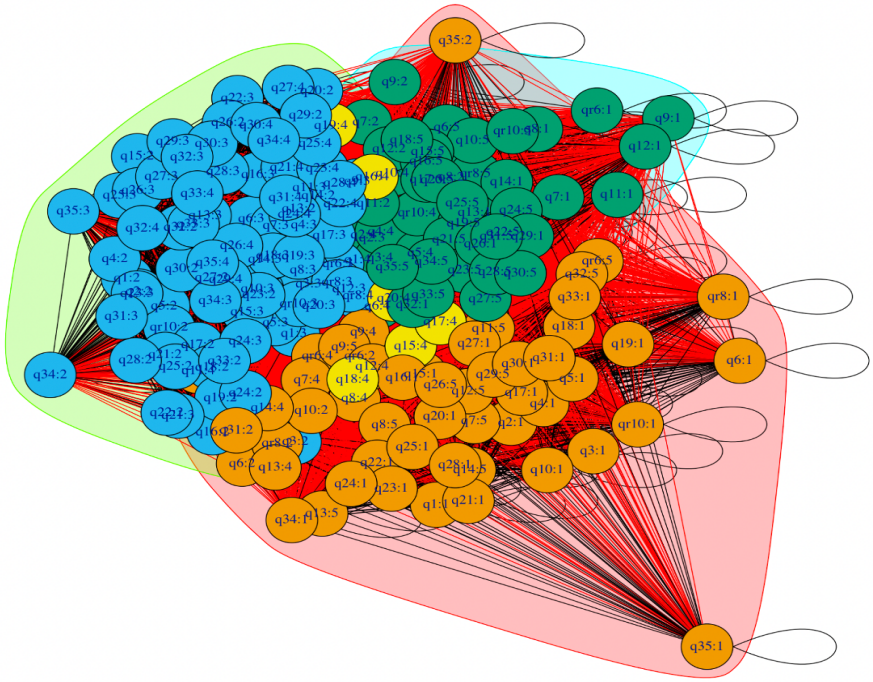

Figure 15.3 : Leiden clusterin for Survey 4

Description	Code
communicate very confidently with my primary care provider about my healthcare needs.	q1
I have very positive relationships with my healthcare professionals.	q2
I confidently give healthcare professionals the information they need to help me	q3
I get my needs met from available healthcare resources (e.g. doctors, hospitals, and community services)	q4
I work in a team with my doctors and other healthcare professionals.	q5
In the last month, how often have you been able to control irritations in your life?	q6
In the last month, how often have you been angered because of things that were outside of your control?	q7
In the last month, how often have you found that you could not cope with all the things that you had to do?	q8
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	q9
In the last month, how often have you felt confident about your ability to handle your personal problems?	q10
In the last month, how often have you felt nervous and "stressed"?	q11
In the last month, how often have you felt that you were on top of things?	q12
In the last month, how often have you felt that things were going your way?	q13
In the last month, how often have you felt that you were unable to control the important things in your life?	q14
In the last month, how often have you been upset because of something that happened unexpectedly?	q15
Little interest or pleasure in doing things?	q16
Feeling down, depressed, or hopeless?	q17
to help you if you were confined to bed?	q18
to take you to the doctor if you need it?	q19
to share your most private worries and fears?	q20
to turn to for suggestions about problems?	q21
to do something enjoyable with?	q22
to love and make you feel wanted?	q23
My outward appearance represents my gender identity.	q24
I experience a sense of unity between my gender identity and my body.	q25
My physical appearance adequately expresses my gender identity.	q26
I am generally comfortable with how others perceive my gender identity when they look at me.	q27

My physical body represents my gender identity.	q28
The way my body currently looks does not represent my gender identity.	q29
I am happy with the way my appearance expresses my gender identity.	q30
I do not feel that my appearance reflects my gender identity.	q31
I feel that my mind and body are consistent with one another.	q32
I feel that my mind and body are consistent with one another.	q33
I feel that my mind and body are consistent with one another.	q34
I am not proud of my gender identity.	q35
I am not proud of my gender identity.	q36
I am happy that I have the gender identity that I do.	q37
I have accepted my gender identity.	q38

Table 1.1 Mapping of questions with their description

Answer options	**Answer coding**
Strongly Disagree	1
Somewhat disagree	2
Neither agree nor disagree	3
Somewhat agree	4
Strongly Agree	5
Never	1
Almost never	2
Sometimes	3
Fairly Often	4
Very Often	5
None of the time	1
A little of the time	2
Some of the time	3
Most of the time	4
All of the time	5

Table 1. 2 Mapping of answers with corresponding numeric code

race_t0	Survey 1				Survey 4			
	clust_1	clust_2	clust_3	clust_4	clust_1	clust_2	clust_3	clust_4
Black or African American	19	47	66	31	7	39	43	24
White	55	50	62	68	17	51	52	34
American Indian or Alaska Native,Other	0	1	0	0	0	0	0	0
Other	10	9	22	11	6	11	7	6
American Indian or Alaska Native,Black or African American,White	0	0	1	2	0	0	2	0
American Indian or Alaska Native,Black or African American	1	1	0	0	0	1	0	0
American Indian or Alaska Native	2	3	7	6	0	3	7	3
Native Hawaiian or Other Pacific Islander	4	4	2	3	0	0	4	0
Black or African American,Other	0	1	0	0	0	0	0	0
White,Other	2	3	2	3	2	1	1	2
Asian,Other	3	0	0	0	1	0	0	0
American Indian or Alaska Native,White	3	1	1	5	1	3	1	3
Black or African American,White	1	3	6	2	0	1	3	2
Asian	4	2	6	2	1	4	2	3
Asian,Native Hawaiian or Other Pacific Islander,White	0	1	0	0	0	0	0	0
Asian,White	1	1	3	1	1	1	0	1
Black or African American,White,Other	1	0	0	1	0	0	0	1
American Indian or Alaska Native,Asian,Native Hawaiian or Other Pacific Islander	0	0	1	0	0	0	0	0
Asian,Black or African American,White,Other	1	0	0	0	0	1	0	0
American Indian or Alaska Native,White,Other	0	0	0	1	0	0	0	1
Asian,Native Hawaiian or Other Pacific Islander	0	0	2	0	0	1	1	0
Asian,Black or African American,White	0	0	0	1	0	0	0	1
Native Hawaiian or Other Pacific Islander,White	0	1	0	0	0	0	1	0
Asian,Black or African American,Other	0	0	0	1	0	0	0	0

Table 2.1 Cluster by race

hispanic_t0	race_t0	Survey 1				Survey 4			
		clust_1	clust_2	clust_3	clust_4	clust_1	clust_2	clust_3	clust_4

1	Black or African American	4	2	15	1	1	7	3	5
0	Black or African American	15	45	51	30	6	32	40	19
0	White	44	38	47	58	12	42	41	29
1	American Indian or Alaska Native,Other	0	1	0	0	0	0	0	0
1	White	11	12	14	10	5	8	11	5
1	Other	6	8	18	10	5	10	5	4
0	American Indian or Alaska Native,Black or African American,White	0	0	0	2	0	0	2	0
0	American Indian or Alaska Native,Black or African American	1	0	0	0	0	0	0	0
0	American Indian or Alaska Native	1	2	5	4	0	2	5	2
0	Native Hawaiian or Other Pacific Islander	4	4	2	3	0	0	4	0
1	Black or African American,Other	0	1	0	0	0	0	0	0
1	White,Other	0	2	2	1	1	1	1	1
0	Asian,Other	2	0	0	0	1	0	0	0
1	American Indian or Alaska Native,White	0	1	0	2	0	1	0	1
0	Black or African American,White	1	3	5	1	0	1	3	1
0	Asian	4	2	6	2	1	4	2	3
0	American Indian or Alaska Native,White	3	0	1	3	1	2	1	2
0	Other	4	1	4	1	1	1	2	2
0	White,Other	2	1	0	2	1	0	0	1
0	Asian,Native Hawaiian or Other Pacific Islander,White	0	1	0	0	0	0	0	0
1	American Indian or Alaska Native,Black or African American	0	1	0	0	0	1	0	0
0	Asian,White	1	1	3	1	1	1	0	1
1	Black or African American,White,Other	1	0	0	1	0	0	0	1
0	American Indian or Alaska Native,Asian,Native Hawaiian or Other Pacific Islander	0	0	1	0	0	0	0	0
1	Asian,Black or African American,White,Other	1	0	0	0	0	1	0	0

1	American Indian or Alaska Native	1	1	2	2	0	1	2	1
1	American Indian or Alaska Native,White,Other	0	0	0	1	0	0	0	1
0	Asian,Native Hawaiian or Other Pacific Islander	0	0	2	0	0	1	1	0
1	American Indian or Alaska Native,Black or African American,White	0	0	1	0	0	0	0	0
1	Black or African American,White	0	0	1	1	0	0	0	1
1	Asian,Other	1	0	0	0	0	0	0	0
0	Asian,Black or African American,White	0	0	0	1	0	0	0	1
0	Native Hawaiian or Other Pacific Islander,White	0	1	0	0	0	0	1	0
0	Asian,Black or African American,Other	0	0	0	1	0	0	0	0
1	Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0

Table 2.2 Cluster by hispanic/non-hispanic and race

	Survey 1				Survey 4			
hispanic_t0	clust_1	clust_2	clust_3	clust_4	clust_1	clust_2	clust_3	clust_4
1	26	33	55	31	14	32	22	21
0	82	99	127	109	24	87	102	61

Table 2.3 Cluster by hispanic/non-hispanic

Survey1			
cluster 1	**cluster 2**	**cluster 3**	**cluster 4**
q1:2	q1:4	q6:3	q6:4
q1:3	q2:4	qr6:3	qr8:4
q2:2	q3:4	q7:3	q15:4

Survey4			
cluster 1	**cluster 2**	**cluster 3**	**cluster 4**
q1:1	q1:2	q1:4	q15:4
q2:1	q1:3	q2:4	q16:4
q3:1	q2:2	q3:4	q17:4

q2:3	q4:4	q8:3	q16:4
q3:2	q5:4	qr8:3	q17:4
q3:3	q6:5	q9:3	q18:4
q4:2	qr6:1	q9:4	q19:4
q4:3	qr6:2	q10:3	q20:4
q5:2	q7:1	qr10:3	q21:4
q5:3	q7:2	q11:3	q22:4
q6:1	q8:1	q12:3	q23:4
q6:2	q8:2	q13:3	q24:4
qr6:4	qr8:5	q14:3	q25:4
qr6:5	q9:1	q15:3	q26:2
q7:4	q9:2	q16:3	q27:4
q7:5	q10:4	q17:3	q28:4
q8:4	q10:5	q18:3	q29:2
q8:5	qr10:4	q19:3	q30:4
qr8:1	qr10:5	q20:3	q31:4
qr8:2	q11:1	q21:3	q32:2
q9:5	q11:2	q22:3	q33:4
q10:1	q12:1	q23:3	q34:4
q10:2	q12:2	q24:3	
qr10:1	q13:1	q25:3	
qr10:2	q13:2	q26:3	
q11:4	q14:1	q27:3	
q11:5	q14:2	q28:3	
q12:4	q15:5	q29:3	
q12:5	q16:5	q30:3	
q13:4	q17:5	q31:3	
q13:5	q18:5	q32:3	
q14:4	q19:5	q33:3	
q14:5	q20:5	q34:3	
q15:1	q21:5	q35:3	

q4:1	q2:3	q4:4	q18:4
q5:1	q3:2	q5:4	q19:4
q6:1	q3:3	q6:4	q20:4
q6:2	q4:2	q6:5	
qr6:4	q4:3	qr6:1	
qr6:5	q5:2	qr6:2	
q7:4	q5:3	q7:1	
q7:5	q6:3	q7:2	
q8:4	qr6:3	q8:1	
q8:5	q7:3	q8:2	
qr8:1	q8:3	qr8:5	
qr8:2	qr8:3	q9:1	
q9:4	qr8:4	q9:2	
q9:5	q9:3	q10:4	
q10:1	q10:3	q10:5	
q10:2	qr10:2	qr10:4	
qr10:1	qr10:3	qr10:5	
q11:4	q11:3	q11:1	
q11:5	q12:3	q11:2	
q12:4	q13:2	q12:1	
q12:5	q13:3	q12:2	
q13:4	q14:2	q13:1	
q13:5	q14:3	q14:1	
q14:4	q15:2	q15:5	
q14:5	q15:3	q16:5	
q15:1	q16:2	q17:5	
q16:1	q16:3	q18:5	
q17:1	q17:2	q19:5	
q18:1	q17:3	q20:5	
q19:1	q18:2	q21:5	
q20:1	q18:3	q22:5	

q15:2	q22:5
q16:1	q23:5
q16:2	q24:5
q17:1	q25:5
q17:2	q26:1
q18:1	q27:5
q18:2	q28:5
q19:1	q29:1
q19:2	q30:5
q20:1	q31:5
q20:2	**q32:1**
q21:1	**q32:5**
q21:2	q33:1
q22:1	q33:5
q22:2	q34:5
q23:1	q35:5
q23:2	
q24:1	
q24:2	
q25:1	
q25:2	
q26:4	
q26:5	
q27:1	
q27:2	
q28:1	
q28:2	
q29:4	
q29:5	
q30:1	
q30:2	

q21:1	q19:2	q23:5
q22:1	q19:3	q24:5
q23:1	q20:2	q25:5
q24:1	q20:3	q26:1
q25:1	q21:2	q27:5
q26:5	q21:3	q28:5
q27:1	q21:4	q29:1
q28:1	q22:2	q30:5
q29:5	q22:3	q31:5
q30:1	q22:4	**q32:1**
q31:1	q23:2	q33:5
q31:2	q23:3	q34:5
q32:5	q23:4	
q33:1	q24:2	
q34:1	q24:3	
	q24:4	
	q25:2	
	q25:3	
	q25:4	
	q26:2	
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	q26:4	
	q27:2	
	q27:3	
	q27:4	
	q28:2	
	q28:3	
	q28:4	
	q29:2	
	q29:3	
	q29:4	

q31:1	q30:2
q31:2	q30:3
q32:4	q30:4
q33:2	q31:3
q34:1	q31:4
q34:2	q32:2
q35:1	q32:3
q35:2	q32:4
q35:4	q33:2

Table 3: Clustering of events for Survey 1 and Survey 4