

PATTERNS OF CROSS-SYSTEM INVOLVEMENT AND FACTORS ASSOCIATED  
WITH FREQUENT CYCLING: THE RELATIONSHIP BETWEEN EMERGENCY  
DEPARTMENT VISITS AND ARREST BY POLICE

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By Courtney Sheppard Harding

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Committee:

Caterina G. Roman, Ph.D., Advisory Chair, Department of Criminal Justice

Wayne Welsh, Ph.D., Department of Criminal Justice

Jennifer Wood, Ph.D., Department of Criminal Justice

Jeffrey T. Ward, Ph.D., Department of Criminal Justice

Stephen Metraux, Ph.D., External Member, Biden School of Public Policy, University of  
Delaware

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## ABSTRACT

A particularly unhealthy and high-risk group of individuals at the intersection of the criminal justice and public health systems often cycle between arrest, jail, prison, public hospitals, emergency departments, homeless shelters, and similar institutions over time. This population, while relatively small, represents disproportionate public spending and complex, multidimensional needs. The overarching goal of the current study is to gain a deeper understanding of the patterns and dimensions of frequent cross-system involvement, or repeat cycling between the criminal justice and public health systems. Specifically, the overlap of arrest by police and contact with the ED was examined. A secondary goal was to illuminate what factors work together to encourage or differentiate between various patterns of cross-system cycling. Group-based trajectory modeling was used to determine patterns of arrest and ED contact among adults that accessed these systems in Camden, NJ between 2010 and 2014. These groups were then brought together to determine patterns of cross-system involvement with a focus on patterns representative of frequent cycling between arrest and the ED. These joint groups were then described in detail using descriptive and predictive methods. By comparing across different patterns of frequent cycling, it is clear that cross-system involved individuals do not represent a homogenous group; nor is mental illness and substance abuse the only factors driving this overlap. The most frequent joint trajectory groups exhibited significantly more ED visits to address injuries including skull-related injuries, chronic physical health conditions, dental and skin issues, anxiety, depression, suicide attempts, substance abuse and co- and multimorbidity measured as chronic conditions experienced with behavioral health concerns and drug/alcohol abuse. Arrests for disorderly, drug and

prostitution offenses were also significantly more prevalent among frequent cross-system cyclers when compared to groups with fewer system contacts. Many of these same factors were also more prevalent among a subsample of young adults aged 18 in 2010 with repeat contacts with both systems. These steps, together with qualitative interviews with service providers in the Camden community, illuminated important factors associated with more frequent arrest and ED contact. These are important contributions to criminological research as discussion is often restricted to behavioral health and is less often concerned with physical health, co- and multi-morbidity. This is also among the first research studies to dig deeper into specific diagnoses associated with frequent arrest and frequent cross-system cycling, among adults and young adults. Healthcare provider interviews were able to confirm that certain issues like dental and skin conditions, depression, anxiety and suicide attempts/ideation tend to increase in prevalence as system contacts accumulate. These are factors that could be targeted earlier in the lifecourse in order to reduce cross-system cycling – an important form of concentrated disadvantage and vulnerability on which to focus attention and resources.

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*“This has all been wonderful but now I’m on my way.” -- Phish*

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## TABLE OF CONTENTS

ABSTRACT.....	iii
ACKNOWLEDGEMENTS .....	v
CHAPTER 1: INTRODUCTION .....	1
CHAPTER 2: LITERATURE REVIEW .....	5
Justice System Involvement, Poor Health and Public Health System Involvement.....	5
Frequent Justice System Contacts and Poor Health.....	9
Health Service Utilization by Criminal Justice Populations.....	11
General Strain Theory and the Causal Relationship between Health and Crime .....	14
Agnew’s General Strain Theory .....	14
Health-Related Strain.....	16
Arrest by Police & Utilization of the Emergency Department .....	19
Frequent Emergency Department Utilization .....	21
The Role of Justice System Involvement in Frequent Contact with the ED.....	23
CHAPTER 3: METHODOLOGY .....	29
Purpose of the Current Study.....	29
Research Questions and Hypotheses .....	30
Overview of Quantitative Data .....	34
Overview of Quantitative Samples .....	36
Overview of Qualitative Data.....	37
Quantitative Measures .....	38
Description of Outcome Variables for all Trajectory Models .....	39
Description of Covariates.....	40
Missing Quantitative Data .....	49

Statistical Analysis Plan.....	50
Group-Based Trajectory Modeling & Model Selection.....	51
Cross-Classification Analysis .....	55
Predictors of Joint Trajectory Group Membership .....	55
Young Adult Subsample Analyses .....	57
Qualitative Interviews & Analysis.....	57
Data Access.....	59
<b>CHAPTER 4: QUANTITATIVE RESULTS .....</b>	<b>60</b>
Overall Description of Quantitative Sample.....	60
[RQ1] Health Disparities between Arrestees and Non-Arrestees.....	62
[RQ2 & RQ3] Group-based Trajectory Modeling, Arrest and ED Contact .....	66
Model selection: Arrest, Full Sample .....	66
Describing final arrest trajectories .....	69
Factors that differentiate between arrest groups .....	71
Model selection: ED Visits, Full Sample.....	78
Describing final ED groups .....	81
Factors that differentiate between ED groups.....	82
[RQ4] Relationship between Arrest and ED Trajectories .....	87
Cross-Classification Analysis – Full Sample.....	88
[RQ5] Predicting Joint Trajectory Group Membership .....	91
Brief Description of Joint Trajectory Groups .....	92
Factors Predicting Frequent Cross-System Involvement.....	99
[RQ6] Arrest and ED Trajectories for Young Adult Subsample.....	103
Describe young adult subsample.....	103
Group-based Trajectory Modeling – Young Adult Subsample .....	104
Model selection: Arrest, Young Adult Subsample .....	105

Describing final young adult arrest trajectories .....	107
Model selection: ED Visits, Young Adult Subsample.....	111
Describing final young adult ED use trajectories .....	114
CHAPTER 5: QUALITATIVE RESULTS .....	122
[RQ7 Service Provider Insights into Trajectory Groups .....	124
Substance Abuse and Mental Illness.....	124
Physical health .....	127
Comorbidity & Multimorbidity .....	130
Homelessness .....	131
Violence .....	132
Role of Age in Frequent Cross-System Involvement .....	133
Service Provider Recommendations .....	135
CHAPTER 6: DISCUSSION.....	139
Key Findings from Research Questions 1 through 4.....	139
The Health of Arrestees .....	139
Health and Accumulating CJ Involvement.....	141
ED Contact for Skin Conditions .....	142
The Relationship between Arrest and ED Contact .....	143
Frequent Cross-System Involvement.....	145
Mental Health & Substance Abuse .....	146
Chronic Physical Health Conditions.....	150
Injuries & Violence.....	152
Comorbidity & Multimorbidity .....	155
General Strain Theory and Health-Related Strain .....	157
Limitations .....	160
Implications .....	166

Research Implications .....	166
Practice and Policy Implications.....	173
REFERENCES .....	182
APPENDIX A. IRB APPROVAL .....	195
APPENDIX B. TABLE INCLUDING ALL VARIABLES USED IN ALL ANALYSES .....	196
APPENDIX C. QUALITATIVE INTERVIEW GUIDE.....	200
APPENDIX D. CODING SCHEME FOR QUALITATIVE INTERVIEW & COUNTS FOR EACH CODE .....	202
APPENDIX E. ARRESTS AND ED USE BY YEAR (1-5) FOR ARREST AND ED TRAJECTORIES, YOUNG ADULT SUBSAMPLE .....	204
APPENDIX F. PERCENT OF PEOPLE THAT VISITED THE ED BY NUMBER OF ARRESTS .....	206
APPENDIX G. BREAKING OUT CHRONIC CONDITION GROUPING VARIABLE INTO INDIVIDUAL DIAGNOSES FOR EACH TRAJECTORY GROUP.....	207
APPENDIX H. TRAJECTORY MODEL DIAGNOSTIC TABLES.....	208
APPENDIX I. RISK RATIOS COMPARING “LEVELS” OF CROSS-SYSTEM INVOLVEMENT .....	212
(LOW, MID, HIGH) .....	212
APPENDIX J. ADDITIONAL REGRESSION MODELS .....	215
APPENDIX K. DESCRIPTIVE TABLES RUN WITH ONLY INDIVIDUALS WHO RESIDED IN CAMDEN CITY BETWEEN 2010 AND 2014 .....	217

## LIST OF TABLES

<b>Table 1.</b> <i>Demographics and System Involvement for Full Adult Sample</i> .....	61
<b>Table 2.</b> <i>Comparing ED Users who were Arrested, to those who were Not Arrested, between 2010 and 2014, on Demographics and Reasons for ED Contact</i> .....	65
<b>Table 3.</b> <i>Demographic, Health- and Justice-Related Characteristics for each Arrest Trajectory, Full Sample (n=26,626)</i> .....	74
<b>Table 4.</b> <i>Logistic Regression Models Predicting Membership in High Arrest Trajectory [G6] (n=227)</i> .....	78
<b>Table 5.</b> <i>Demographic, Health- and Justice-Related Characteristics for each ED Trajectory, Full Sample (N=414,942)</i> .....	84
<b>Table 6.</b> <i>Basic Cross-Tabulation of Arrest and ED Joint Trajectory Groups</i> .....	88
<b>Table 7.</b> <i>Demographic, Health- and Justice-Related Characteristics of Joint Arrest/ED Trajectory Groups: 4 Most “Frequent” Cross-System Involved Groups and Low Arrest/Low ED Group for Comparison</i> .....	96
<b>Table 8.</b> <i>Binary Logistic Regression: Predicting Frequent Cross-System Involvement</i>	100
<b>Table 9.</b> <i>Binary Logistic Regression Model to Identify Independent Predictors of Frequent Cross-System Involvement [G12 &amp; G13]</i> .....	102
<b>Table 10.</b> <i>Demographics and System Involvement for Young Adult Subsample</i> .....	104
<b>Table 11.</b> <i>Demographic, Health- and Justice-Related Characteristics for each Arrest Trajectory, Young Adult Subsample (N=986)</i> .....	109
<b>Table 12.</b> <i>Demographic, Health- and Justice-Related Characteristics for each ED Trajectory, Young Adult Subsample (N=8,242)</i> .....	115

**Table 13.** *Binary Logistic Regression Models Using ED Contact during each Year (1-5) to Predict Membership in Higher Arrest Trajectories, Young Adult Subsample* ..... 118

**Table 14.** *Description of Qualitative Participants* ..... 123

## LIST OF FIGURES

<b>Figure 1.</b> <i>Mean (Observed) Number of Arrests for each Arrest Trajectory per Six-Month Time Period, Full Adult Sample (N=26,626)</i> .....	67
<b>Figure 2.</b> Mean (Observed) Number of ED Contacts for each ED Trajectory per Six-Month Time Period, Full Adult Sample (N=414,942).....	80
<b>Figure 3.</b> Probability of Membership in a Given Arrest Trajectory Conditional on Membership in a Given ED Use Trajectory .....	90
<b>Figure 4.</b> Mean (Observed) Number of Arrests for each Arrest Trajectory per Six-Month Time Period, Young Adult Subsample (n=986) .....	105
<b>Figure 5.</b> Mean (Observed) Number of ED Contacts for each ED Trajectory per Six-Month Time Period, Young Adult Subsample (n=8,242).....	112
<b>Figure 6.</b> Mean Number of ED Contacts for each Arrest Trajectory per Year, Young Adult Subsample (n=986).....	120

## **CHAPTER 1: INTRODUCTION**

Criminal justice officials have long known that a small subgroup of people is responsible for disproportionately high rates of involvement in the justice system. A more recent development is the realization that many of the same individuals who experience frequent criminal justice interactions also frequently contact public health institutions during the same period of time (Milgram et al., 2018). Individuals who repeatedly find themselves at the intersection of criminal justice and public health – referred to by some as “super utilizers”, “frequent fliers”, or “frequent systems users” – experience periods of cycling between arrest, jail, prison, the emergency department (ED), public hospitals, detox centers, homeless shelters, and the like. These populations present a myriad of significant, complex and multidimensional needs including severe mental illness, drug and alcohol abuse, homelessness, chronic and communicable disease, extreme poverty, and many combinations thereof (Gilchrist-Scott & Fontaine, 2012; Harding & Roman, 2017). These issues work together in many ways to thrust people into an “institutional circuit” that becomes increasingly difficult to exit (Hopper et al., 1997).

A growing number of collaborations have formed in recent years guided by the belief that the best way to address the needs of these shared populations is to integrate resources, funding, and information between the usually siloed criminal justice and public health systems (Cloud et al. 2014; Laura and John Arnold Foundation, 2017; Listwan & LaCourse, 2017; The White House, Office of the Press Secretary, 2016). A common strategy for addressing the complex needs these individuals present is to identify the most important underlying factors in order to target them with specific programs and services that consider the wide range of, and interplay between, these issues. While a

promising approach, research is lacking on frequent cross-system involvement as a whole. Notably, we have little in-depth information about the health and social factors that drive cross-system involvement including what issues increase in prevalence and severity as system contacts accumulate. The goal of the current study is therefore to provide a thorough and methodologically rigorous description of the frequent cross-system involved population in one city (Camden, NJ). This includes attention to behavioral and physical health conditions, comorbidity, and the ways in which the most frequently system involved adults differ from those with more sporadic contact with the criminal justice and public health systems.

To date, the study of frequent utilizers has also rarely incorporated a temporal dimension; and has not been guided or informed by theory. The current dissertation employed Agnew's General Strain Theory (1992) and the concept of health-related strain (Stogner & Gibson, 2010) to inform the research questions and guide interpretation of results. This theoretical approach sheds important light on how poor health could encourage crime and justice system involvement, and vice-versa. In the end, the current study will generate profiles (in the form of trajectory groups) that are statistically reliable, robustly described, and helpful to service providers in the Camden, NJ community and at large. Interviews were also conducted with service providers in the Camden community in order to shed more light on findings from the quantitative analyses. The intent is for these profiles to assist in the development of specific services, service packages, or policy initiatives in the pursuit of targeting resources to the specific clusters of need presented by the most health-vulnerable subpopulations of the criminal justice system.

To be discussed in detail later, this dissertation extends a number of findings important to the fields of criminology and public health. When looking at a general sample of arrestees that visited the ED between 2010 and 2014 compared to their non-arrested peers, results showed that a significantly higher proportion of justice-involved adults visited the ED for all of the diagnoses examined – everything from abdominal pain, chronic conditions, dental issues, skin conditions and injuries, to mental illness, substance abuse, co- and multi-morbidity. More arrestees than non-arrestees also visited the ED multiple times to address dental issues, injuries, skin conditions, mental illness and substance abuse. The largest between-group differences were in mental illness, substance abuse, skin conditions, injuries, wounds, multiple injuries, dental issues, and co-occurring mental illness and substance abuse. In general, these findings implicate a relationship between a range of health-related issues (or overall poor health) and an increase in offending over time.

Next, I found overwhelming support for a relationship between arrest and contact with the ED (Frank et al., 2014). For one, as arrests accumulated, ED contact became almost inevitable for adults in this sample with 96% of the highest arrest trajectory [G6] and 92% of the increasing arrest group [G2] making at least one ED contact compared to 55% of the trajectory with the fewest arrests [G3]. The same pattern was observed for young adults (more arrests, higher prevalence of ED contact). As hypothesized, I also found that members of the “frequent” arrest trajectories (increasing [G2] and high [G6]) were significantly more likely to also belong to “frequent” ED trajectories (mid and high) than was expected by chance. This extensive overlap means these systems should not be conceptualized as working in isolation. Any effort to understand and address frequent

arrest must incorporate information on contact with other systems given how likely it is for cross-system contacts to emerge.

The results to be discussed below indicate that knowing someone is cross-system involved does not tell the whole story. Namely, as cross-system contact increases in frequency, health issues like injuries, skin conditions, dental concerns, chronic conditions and behavioral health became more complex and significant. The largest differences between levels of cross-system involvement were related to mental illness and substance abuse, which consistently increased across joint groups. Service providers interviewed for this study reiterated and emphasized this point. ED contact for depression predicted frequent cycling; and rates of ED visits for anxiety, depression and suicide increased precipitously across levels of cross-system involvement. The presence of any chronic condition also increased a cross-system involved adult's odds of frequent cycling by more than 14 times. This was not only an issue for older people but also members of 18-year-old subsample. Also related to physical health, multimorbidity was associated with frequent arrest and frequent cross-system involvement.

Lastly, the presence of health strain (measured as contact with the ED) predicted more arrests for people in my sample, even young adults; and this relationship was reciprocal with arrest predicting more contact with the ED. Overall, this study illuminated key factors associated with the most problematic forms of arrest and ED overlap. These health and justice-related issues should be targeted, some even early in the lifecourse, in order to prevent these forms of cross-system cycling thus suffering and vulnerability.

## **CHAPTER 2: LITERATURE REVIEW**

Frequent cross-system involvement is one manifestation of the broader and very complex relationship between poor health and criminal behavior. In order to provide a thorough empirical foundation for this study, a review of the literature will be broken into sections that gradually narrow the focus from the health of justice-involved populations to the issue of frequent and concurrent arrest and ED utilization. This dissertation makes the case that the specific overlap of arrest by police and utilization of the ED is a particularly important interaction between criminal justice and public health on which to focus attention. For starters, both are crisis-based and could be perceived as “systems of last resort” for resolving urgent issues. This makes involvement with police and the ED both expensive and potentially avoidable by expanding the options available to address significant issues before they reach the level of an emergency. This section will explain why this overlap is meaningful, as well as what we know about the role of justice system involvement in utilization of the ED.

### **Justice System Involvement, Poor Health and Public Health System Involvement**

As a group, justice-involved individuals experience much worse health than those in the general population (Center for Behavioral Health Statistics and Quality, 2015; Binswanger et al., 2009; 2010; 2012; James & Glaze, 2006; Link et al., 2019; Vaughn et al., 2012). Specifically, justice-involved adults have been found to experience greater rates of chronic and communicable illnesses like hypertension, asthma, arthritis, cervical cancer, cirrhosis, tuberculosis, HIV/AIDS, and hepatitis when compared to their non-justice involved peers (Binswanger et al., 2009; Binswanger et al., 2012). Among a nationally representative sample of jail detainees, nearly 40% of males and 56.8% of

females reported at least one serious physical health condition (Binswanger et al., 2010). Also of interest, young adults engaged in violence have been found to experience greater odds of developing chronic health conditions in adulthood (Reingle et al., 2014). While this body of work on the interaction between health and crime is newer and still growing, it appears to show that justice-involved youth and adults experience more physical health-related concerns than their non-involved peers.

Behavioral health issues are also greatly overrepresented within the criminal justice system. While an average of 18% of the general U.S. adult population report a mental health diagnosis (Center for Behavioral Health Statistics and Quality, 2015), an estimated 64% of U.S. jail detainees experience mental illness (James & Glaze, 2006). *Serious* mental illnesses like schizophrenia, schizoaffective disorder, other delusional and psychotic disorders, and major mood disorders like depression and bipolar are experienced by 14.5% of male and 31% of female jail inmates (Steadman et al., 2009). More specifically, bipolar disorder is associated with a higher frequency of violent crime than for offenders without bipolar disorder; and rates are even higher when substance abuse is co-occurring (Fovet et al., 2015). Drug and alcohol abuse are experienced by many with justice system involvement. One nationwide survey of state and Federal prisoners estimated that roughly 50% met formal diagnostic criteria for drug abuse or dependence (Mumola & Karberg, 2006). Among jail inmates with a *serious* mental illness, 56-67% report co-occurring substance abuse (James & Glaze, 2006; Constantine et al., 2010).

Further complicating these issues, many justice-involved adults experience a combination of physical and mental illness. Scholars at The Urban Institute examined the

reentry experiences of more than 1,000 men and women released from prison in Ohio and Texas in 2004 and 2005. The authors found 39% of men and 62% of women self-reported multiple types of health conditions (i.e., physical health, mental health, substance abuse), with roughly 7% of men and 18% of women in reporting a condition in all three categories (Mallik-Kane & Visher, 2008). A similar study analyzed administrative data to better understand the medical problems of individuals with severe mental illness (SMI) by comparing outcomes of those with, to those without, a history of incarceration (Cuddeback et al., 2010). People with SMI in the justice-involved group were significantly more likely than those with no incarceration history to experience infectious diseases and a history of injury. After controlling for age, gender, ethnicity, and presence of a substance abuse disorder, individuals with SMI and an incarceration history remained 40% more likely than those without justice system involvement to have a medical condition, and 30% more likely to experience multiple medical issues at the same time (Cuddeback et al., 2010).

For many people supervised by the criminal justice system, poor health is experienced in the context of unfavorable socioeconomic circumstances which serve as barriers to good health (Mallik-Kane & Visher, 2008; Holzer, 2007; Harrell et al., 2014). For one, poverty is overrepresented in the criminal justice system. Estimates state more than sixty percent of incarcerated and formerly incarcerated individuals live at or below the federal poverty line (Guyer et al., 2015); and impoverished individuals are significantly more likely to contact the justice system (Hashimoto, 2013). Poverty, lower wages and damage to an individual's employability are major consequences of incarceration (Visher et al., 2008; Holzer, 2007). Incarcerated adults also earn

significantly less prior to ever going to prison or jail. A report by Rabuy & Kopf (2015) of the non-profit Prison Policy Initiative reviewed “underutilized” data from the Bureau of Justice Statistics (BJS) and found justice-involved adults in 2014 earned a median annual income of \$19,185 prior to their first term of incarceration – 41% less than that of their non-incarcerated peers. Individuals with justice system involvement also, as a group, achieve much lower levels of education than non-justice involved adults – likely contributing to high rates of unemployment for this population (Harlow, 2003).

Nearly 15% of U.S. jail inmates report being homeless during the year prior to incarceration – a rate 7.5 to 11.3 times higher than the risk of the general U.S. adult population (Greenberg & Rosenheck, 2008). Early studies on this overlap found anywhere from 4% to 49% of homeless samples reported a prior incarceration in prison (Shlay & Rossi, 1992). A classic study on the link between incarceration and homelessness in New York City between 1995 and 1998 found approximately 6% of people utilized a homeless shelter prior to incarceration in prison, and 11.4% entered a homeless shelter after release (Metraux & Culhane, 2004). Jail inmates with a mental illness are twice as likely as those without a mental health diagnosis to have been homeless in the year before arrest (James & Glaze, 2006). In the end, it is clear that the justice system in the U.S. – an institution not necessarily focused on improving health and wellbeing – interacts with many of the most health-vulnerable and disadvantaged individuals in our society.

### ***Frequent Justice System Contacts and Poor Health***

Evidence suggests that people who repeatedly interact with the criminal justice system may experience even worse health and more of its associated consequences than the general criminal justice population (Ford, 2005; Constantine et al., 2010; MacDonald et al., 2015; Lorvick et al., 2018). Mary C. Ford (2005) examined characteristics of a group of 19 Florida offenders deemed “frequent fliers” of the justice system in 2003. Each individual in the sample had at least 20 prior arrests and ten prior incarcerations, with a group mean of 98 lifetime cases. “Frequent fliers” as a group had a much higher prevalence of substance abuse issues, severe mental health diagnoses, and residential instability than general offending populations (Ford, 2005).

The Houston Police Department implemented the Chronic Consumer Stabilization Initiative in 2009 to assist the subgroup of consumers from whom police receive the most calls-for-service to address a mental health crisis (Houston Police Department, 2010). Eligible consumers received four or more Emergency Detention Orders from police during the prior six months – a pattern of behavior representing frequent contact with the justice system triggered by a mental health emergency. Across this “chronic consumer” group, 50% reported significant health issues like diabetes or injuries resulting from trauma, 43% had a diagnosis of schizophrenia, 37% reported substance abuse or dependence, and 20% were homeless.

Constantine and colleagues (2010) examined the arrest trajectories of adults with serious mental illness (SMI) jailed in Pinellas County, FL between July 1, 2003 and the end of June, 2004 and found just 5.5% of their sample accounted for nearly 20% of all arrests recorded that year. Analyses also revealed three distinct classes or groups:

sporadic arrest, low chronic, and high chronic arrest. Multinomial logistic regression models found homelessness, substance abuse diagnoses, being young and male, and individuals with three or more ED contacts were associated with membership in chronic classes (low or high) relative to the group characterized by sporadic involvement. This demonstrates a relationship between emergency department utilization and consistent arrest. The authors also examined the impact of age and found the pattern of high chronic arrest began earlier in adulthood and persisted over time, showing little to no decline with age. As a group, individuals arrested most frequently in this sample demonstrated more acute mental health issues and a greater likelihood of co-occurring substance abuse than groups characterized by less frequent arrest during the same period of time. A link was also demonstrated between repeat ED utilization and chronic arrest.

MacDonald and colleagues (2015) used an individual-level “hot spotting approach” to identify the most frequently jailed at Rikers Island between 2008 and 2014. A rank-ordered sample of the 800 most frequently incarcerated adults (mean of 23 incarcerations) were compared to a randomly-selected control group drawn from the rest of the incarcerated population. The frequently jailed were significantly more likely than controls to experience serious mental illness, homelessness, drug and alcohol abuse, and chronic and communicable health conditions.

Recently, Lorvick and colleagues (2018) that looked at the impact of health on contacting the justice system more often – something they referred to as “CJ accumulation”. Among a sample of drug-abusing women in Oakland, CA, the authors used a range of health and social factors to predict membership in a “mid” or “high” arrest class (LCA) over “low”. The following factors significantly increased one’s odds

of “CJ accumulation”: experiencing homelessness, recent physical assault, recent injection drug use, unmet physical and behavioral health needs, vision and dental issues, depression, bipolar, and any mental illness.

In sum, this small body of research suggests that, as a group, individuals with repeat justice system involvement experience higher rates of certain physical health conditions, acute mental illness, substance abuse, and homelessness when compared to groups characterized by fewer justice system contacts. Worse health therefore seems to be associated with more frequent contact with the criminal justice system.

### ***Health Service Utilization by Criminal Justice Populations***

Many of the same socioeconomic issues experienced by a disproportionate number of people in the U.S. justice system also lead to poor and worsening health. So what do the most vulnerable people in the criminal justice system do – those living in poverty, perhaps without a home, lacking a source of regular income and access to good healthcare – to address the complex health-related issues we know they experience? Only a handful of studies have explored the way in which justice-involved populations navigate healthcare services in the community. While limited, this body of work suggests many rely heavily on public hospitals and emergency departments to meet their needs (Frank et al., 2013; 2014; McConville et al., 2018). The Urban Institute study described above found that roughly 70% of formerly incarcerated people with health issues in their sample pursued some form of treatment during the first ten months post-release from prison (Mallik-Kane & Visser, 2008). Specifically, about 20% of their sample was admitted to the hospital and roughly 30% visited the public ED.

Another study compared rates of hospitalization for roughly 110,000 Medicare beneficiaries released from a correctional facility from 2002 to 2010, to those of a matched control group without histories of incarceration (Wang et al., 2013). Individuals in the justice-involved group were 2.5 times more likely to be admitted to the hospital in the first seven days post-release, two times more likely in the first 30 days, and 1.8 times more likely at 90 days post-release than those without histories of incarceration during the same timeframes (Wang et al., 2013). This echoes a classic study by Binswanger and colleagues (2007) that found the rate of mortality for ex-inmates to be 3.5 times higher than for non-incarcerated adults, particularly during the first two weeks during following release from prison during which mortality rates were 12.7 times higher (Binswanger et al., 2007). Rosen and colleagues (2008) examined causes of mortality for a group of male ex-prisoners and those for matched male controls. Not only was all-cause mortality higher for ex-prisoners than their peers, but the following issues caused death in ex-inmates at a significantly higher rate: homicide, accidents, substance use, HIV, liver disease, liver and lung cancer, cardiovascular and respiratory diseases, and diabetes (Rosen et al., 2008). People incarcerated for more than one year were slightly less likely to be hospitalized post-release than those incarcerated for less than one year (Wang et al., 2013). Justice-involved individuals visited the hospital more often for unmanaged chronic conditions than their non-incarcerated peers like diabetes, asthma and hypertension. These conditions are much more likely to reach an acute level when individuals do not receive adequate primary and preventative care – something people recently released from prison or jail may have trouble securing. The majority of hospital contacts for recently released inmates in this study, however, were for mental health-

related issues and poisoning, either intentional or due to a drug overdose (Wang et al., 2013). The justice-involved sample was also more likely to die outside of a hospital than the matched controls. Taken together, this could reflect a lack of mental health services and poor access to medical treatment post-release.

A study by Meyer and colleagues (2012) examined ED utilization by HIV-positive adults leaving prison and found 56% of their sample visited the ED during the first 12 months post-release. While their sample were individuals with HIV, multivariate models revealed that the severity of one's HIV-related symptoms was not significantly correlated with utilization of the ED. Instead, visiting the ED was associated with moderate to severe depression, living in temporary housing, and severe addiction to alcohol (Meyer et al., 2012). These are important issues faced by many individuals supervised by the criminal justice system regardless of HIV status.

Ramaswamy and colleagues (2015) examined the correlates of healthcare use prior to arrest for male and female jail detainees in Kansas City, MO in 2009. Adults in their sample demonstrated rates of ED utilization significantly higher than for the general population, with 65% of women and 43% of men utilizing the ED in the one year prior to this incarceration. By contrast, roughly 21% of adults in the U.S. utilized the ED for care in 2009. The odds of reporting to an ED immediately prior to incarceration were significantly higher for females and people with mental health diagnoses (Ramaswamy et al., 2015). Health service utilization both precedes and follows justice system involvement, speaking to the complex health issues faced by many in the justice-involved population in the U.S. In sum, public hospitals, particularly EDs, have been critical venues for health-related treatment for returning ex-offenders and individuals otherwise

involved with the U.S. criminal justice system. Hospital EDs provide treatment to many of the most vulnerable individuals in society, many of whom are also justice-involved (McConville et al., 2018). Frequent emergency department usage in general has received considerable empirical attention in recent years. The role of justice system involvement in encouraging frequent utilization of the ED is particularly relevant to this dissertation and will be discussed in more detail below.

### **General Strain Theory and the Causal Relationship between Health and Crime**

The literature above outlined the poor health, socioeconomic circumstances and public health system involvement of criminal justice populations. Through this we see that poor health and criminal behavior are strongly correlated; and criminal justice and public health system involvement often co-occur. While not the only explanation for the health/crime overlap, the concept of strain – particularly health-related strain – provides important insights into the way in which poor health could precede thus drive criminal behavior. This will be unpacked in the section below.

#### ***Agnew's General Strain Theory***

Agnew's General Strain Theory (GST) provides a framework to understand one potential pathway from poor health to crime (Agnew, 1992; 2006). For the purpose of this dissertation, Agnew's GST was used to inform the research questions and assist in the interpretation of findings around the relationship between health and crime. This study did not undertake a direct test of theory. A direct test was not attempted because the administrative data used in this study did not include any measures of stress or perceptions of strain which are key mediators of the relationship between poor health and crime. A well-designed test of GST would also include controlling for the presence of

strain earlier in time and these data provide only a snapshot of five years in an adult's life. GST therefore serves here as only a framework through which to better understand results and potential mechanisms linking poor health and justice system involvement.

The classic theory posits that specific forms of stress (i.e., criminogenic strain) lead to feelings like anger, frustration, or depression which can, in turn, lead an individual to cope through criminal or deviant behavior. A negative emotional state is therefore thought to mediate the relationship between strain and crime. Not every stressful event carries with it the same likelihood that it will be dealt with through criminal coping (Agnew, 1992). Short-term and chronic health issues fit well, however, into the definition of criminogenic strain utilized by GST (Schroeder et al., 2011; Stogner & Gibson, 2010; 2011; Ford, 2014; Kort-Butler, 2017). Agnew (1992) outlines three primary sources of stress that can lead to criminal or delinquent behavior. The first is the stress experienced when an individual is unable to reach his or her valued goals. Most people positively value good health and the absence of illness or injury. Another goal likely to be universally-held is to possess the means and ability to provide for oneself and one's family. This typically means being employed, having steady income and possessing a source of health insurance. Experiencing poverty could work against this goal of self-sufficiency and, in turn, one's desire to maintain good health.

The second source of criminogenic strain outlined by Agnew (1992) is the loss of positively-valued stimuli. Many favorable things come along with good health such as physical strength, confidence, energy, independence, and more disposable income through employment. Additionally, chronic health conditions could lead to loss of a job, friendships, hobbies and other things of extreme value. The third source of criminogenic

strain outlined by GST is the introduction of negative stimuli. It is easy to understand how one could perceive a sudden illness, a violent victimization, an accidental injury, a drug overdose or another health emergency as a negative stimulus. Similarly, hospital stays and ED contacts could themselves be processed as negative events. Health issues, like any criminogenic strain, can inhibit progress toward one's life goals, remove from an individual something they value, or create negative experiences.

The theory further argues that the strains most likely to result in crime are those that are (1) seen as unjust, (2) as high in magnitude, (3) associated with a low level of self-control, and (4) create some incentive to cope by engaging in crime (Agnew, 2001).

These conditions can be easily satisfied through the experience of negative health.

Imagine a scenario in which a person grows frustrated and depressed after her third emergency department visit to address a chronic illness that, due to an inability to afford or otherwise secure health insurance, she is unable to adequately treat. It is not a stretch to then imagine this person choosing to cope by using drugs, for instance, or committing survival crimes. It is likewise easy to see how securing income through traditional means could be difficult for someone with constant health emergencies. These behaviors could lead to worsening health over time, thus starting the cycle over again. This familiar trajectory can be explained using the concept of health-related and criminogenic strain described in GST. It also helps to explain a possible mechanism driving the overlap of frequent ED utilization and arrest.

### ***Health-Related Strain***

The concept of health-related strain (HRS) and its impact on criminal or deviant behavior is a newer addition to the research on GST (Stogner & Gibson, 2010 & 2011;

Schroeder et al., 2011; Ford, 2014; Kort-Butler, 2017). Only a handful of studies exist on HRS, the majority of which focus on the link between adolescent drug use and deviance (Stogner & Gibson, 2010; 2011; Stogner et al., 2014; Kort-Butler, 2017). That being said, studies have consistently found indicators of poor health to have both direct and indirect effects on illegal behavior – results which confirm and extend Agnew’s GST, and provide a way to explain this health/crime relationship.

Stogner and Gibson examined the association between health-related strain and both non-violent delinquency (2010) and adolescent drug use (2011). Their measure of health strain reflected the frequency with which an individual experienced 14 different conditions, each minor enough to not interfere with one’s ability to commit crime (e.g., headaches, stomachaches, joint pain). Regression analyses found that experiencing “health strain” increased the frequency of subsequent delinquent behavior, even when controlling for relevant factors and demographics including anger and depression. Poor health therefore had a direct effect on non-violent delinquency not mediated by negative emotional states. As for drug use initiation, “health strain” significantly increased one’s chances of first using marijuana, cocaine, and harder drugs – the effect of which was strongest for harder drugs (Stogner & Gibson, 2011). While this association was mediated by negative emotions in some cases, this was not consistent across drug types – again demonstrating the direct effect of health-related strain on criminal coping. A study by Kort-Butler (2017) later confirmed the impact of poor health on marijuana use, but found the association between depression and crime to completely disappear in models that include covariates like the presence of other strains, emotionality, absences from school, and academic trouble (Kort-Butler, 2017).

Schroeder and colleagues (2011) used physical health, depression, anxiety, and competing strain to predict criminal behavior in low-income, urban women. Among women with no prior criminal history, better health at baseline and an improvement in health over time were both associated with significantly lower odds of offending for the first time. Anxiety and depression mediated this relationship partially for good health at baseline, and completely for an improvement in health. For prior offenders, reporting good health at baseline and an improvement in health both translated into significantly lower odds of offending again. This study contributed to the HRS literature by extending health strain to an adult sample; and perhaps more importantly, by examining the impact that changes in health over time can have on preventing or reducing crime.

A study by Stogner, Gibson & Miller (2014) considered the *reciprocal* effects of health on criminal behavior, and criminal behavior on health, among adolescents. While this topic has since received increased attention (Link et al., 2019), the authors highlight the fact that few studies consider the effect of poor health on future delinquency, instead treating health issues as spuriously related to criminal behavior. That being said, Stogner and colleagues (2014), using Add Health data on more than 14,000 youth, found experiencing more minor health problems had a significant, positive impact on engaging in violent behavior; and involvement in violence had a significant and negative effect on future health. These findings implicate both criminal behavior as a driver of poor health, and poor health as a driver for criminal behavior, even after controlling for a number of relevant covariates. This *reciprocity* illustrates one way in which a cyclical pattern of frequent ED utilization and arrest by police could emerge.

In the end, evidence suggests that poor health translates into criminogenic strain, which leads to criminal behavior among offenders and non-offenders, adults and juveniles, directly and as a means of coping with negative emotional states. GST and health-related strain are therefore important tools for understanding why individuals with frequent justice system involvement excessively utilize the ED. HRS also seems to have a robust influence on criminal behavior, more so than originally posited in Agnew's GST.<sup>1</sup>

### **Arrest by Police & Utilization of the Emergency Department**

The review of literature above has shown that poor health and criminal behavior are, in many ways, intertwined. There are many manifestations of criminal justice/public health cross-system involvement on which to focus attention. This dissertation makes the case that the specific overlap of arrest by police and utilization of the ED is important for many reasons. For one, the point of this general line of research is to understand frequent cross-system involvement as a whole. Studies on this topic would therefore benefit from examining patterns of public health and justice system involvement that represent a wide range of both health-related issues and types of crime in order to explore multiple dimensions of causality. As a measure of justice system involvement, arrest by police represents a wider range of offenses than do jail or prison-based samples. Anything from a summary offense to a violent felony can, and often does, begin with an arrest.

Similarly, ED utilization serves as a proxy for a wide range of physical and behavioral health issues. People utilize the ED to address health emergencies arising from

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<sup>1</sup> In addition to strain theory, Andersen's Behavioral Model provides a useful framework for understanding how a range of individual and environmental factors impact health system utilization and health outcomes, particularly among vulnerable populations (Gelberg, Andersen, & Leake, 2000). This model is therefore relevant to the relationship between ED use and arrest by police. This body of literature is not detailed here, however, because the data do not include measures of formal or informal help-seeking, nor enough predisposing, need or enabling factors to appropriately reflect the full framework.

accidents, violent injury, complications with medication, long-term disease not properly treated, pregnancy, drug or alcohol abuse, mental health symptoms, and the like. The handful of studies on frequent cross-system involvement – most of which are reports using data from FUSE initiatives – analyze samples of individuals with mental health diagnoses and/or histories of incarceration (Gilchrist-Scott & Fontaine, 2012; Harding & Roman, 2017). These studies miss the frequent cycling experiences of those who are not mentally ill, those with undiagnosed mental illness, and patterns of offending for which people were not incarcerated. Using data on the particular overlap of arrest and utilization of the ED therefore provides valuable insight into the many different ways in which the health/crime relationship manifests.

Next, individuals who are frequently arrested are arguably more health-vulnerable and service-dependent than people at other intercepts of the criminal justice system like those incarcerated, even frequently, in prison and jail. Being just arrested without subsequent supervision means all of the stress associated with justice system involvement (e.g., court appearances, fines, permanent criminal record) and none of the treatment benefits, however limited, of spending time in jail, prison, or being on probation or parole. This is not to discount the detrimental impact of incarceration on individual health, but simply to highlight the unique role of frequent arrest in the health/crime relationship. In fact, Frank and colleagues (2014) found the association between recent criminal justice system involvement and ED utilization was stronger for those arrested only compared to those arrested then supervised through probation or parole. The authors spoke of a protective effect of supervision against poor and worsening health since the needs of probationers and parolees are more likely to be caught and at least minimally

met while under supervision (Frank et al., 2014). This may be because individuals serving a longer sentence were able to stabilize their health while in prison. No one would herald prison-based healthcare or the health benefits of criminal justice supervision. It does open up resources, however, to which disenfranchised individuals including those who are frequently arrested but not subsequently supervised or incarcerated do not have access (Rich et al., 2014).

Lastly, one side of the arrest/ED overlap has received considerable research attention as there is a great deal of literature on frequent utilization of the ED. This line of study can be extended to help inform different hypotheses around what health-related factors may encourage cycling through the public health and criminal justice systems during the same period of time. Samples defined by frequent ED use share a number of characteristics with criminal justice populations. These common factors include serious mental illness, drug and alcohol abuse, co-occurring conditions, chronic and/or infectious diseases, housing instability, poverty, unemployment and a lack of health insurance. More importantly, a small body of research (reviewed below) suggests that arrest by police, even when compared against other forms of justice system contact, plays a unique role in encouraging utilization of the ED in particular.

### ***Frequent Emergency Department Utilization***

The emergency department provides acute care to all individuals who enter, regardless of their ability to pay. As a result, EDs treat both victims of accidents and health emergencies, as well as people in “safety net” populations like the homeless, impoverished and uninsured (Heisler & Tyler, 2014). Like with the justice system, research finds a small subset of patients is responsible for a disproportionate number of

ED visits. For instance, analyses on hospital claims data in Camden, NJ from 2002 to 2007 found that 90% of costs were incurred by 20% of patients; and a cohort of just 36 “super users” reported an average of more than 60 hospital and ED contacts per month, at a monthly cost to hospitals of \$1.2 million (Green et al., 2010).

Scholarship on the frequent ED utilizer population gives us good insight into what characteristics may differentiate sporadic users from those with more problematic patterns of ED use. For instance, Billings and Raven (2013) segmented their sample into groups based on number of ED visits in New York City in 2007, in pursuit of factors predictive of frequent ED use. For individuals with 15 or more ED visits in one year, 63% had multiple chronic conditions, 78.9% had histories of mental illness, 62% were dually diagnosed, 5.9% of ED contacts were for mental illness as the primary concern, and 20% visited the ED for an issue related to substance abuse primarily. The rate of chronic medical conditions, mental health diagnoses, substance abuse, and co-occurring disorders similarly increased consistently across ED user groups. The authors stated that once ED use becomes repeat and frequent over time – like for the group referred to in this article as “serial high users” – the needs presented become more serious, complex and multidisciplinary (Billings & Raven, 2013).

A population-based study examined frequent ED use among one million of Taiwan’s National Health Insurance beneficiaries (Ko et al., 2015). The authors found a history of congestive heart failure (AOR = 2.64) and psychiatric disorders (AOR = 2.35) each increased one’s odds of visiting the ED frequently and consistently over time (Ko et al., 2015). A similar study of ED use by Medicaid beneficiaries in Western New York found individuals with behavioral health diagnoses were significantly more likely to

experience frequent “treat-and-release” ED utilization, or visits that did not lead to an inpatient admission (Castner et al., 2015). Lastly, Brennan and colleagues (2014) found people with at least one ED visit for a mental health concern were more than 4.5% more likely to be frequent ED utilizers. While behavioral health seems to be a primary driver of frequent ED contact, it does not work alone to produce these patterns as many frequent user groups also experience chronic health issues and co-occurring substance abuse.

Frequent ED utilizer populations are clearly not homogenous in terms of their health-related needs and experiences (Krieg et al., 2016; LaCalle & Rabin, 2010). LaCalle & Rabin (2010) argue that members of this population differ “along many dimensions and defy popular assumptions” (p.42). The authors urge future research to uncover subgroups with enough detail so as to inform practice and policy about what specific characteristics should be targeted with services to address and prevent the most problematic patterns of ED utilization. Uncovering factors that cluster together to differentiate patterns of frequent ED utilization from other forms of ED contact is among the objectives of the current dissertation.

### ***The Role of Justice System Involvement in Frequent Contact with the ED***

Noticeably missing from a majority of the literature on frequent ED utilization – and of importance to the current study – is consideration of the role played by criminal justice system involvement in encouraging disproportionate use of the ED, and vice-versa. The small body of research on this specific overlap, however, seems to implicate arrest as an important driver of frequent ED contact.

Kushel and colleagues (2002) examined factors associated with repeat visits to the ED, including those related to criminal justice, by homeless and marginally housed

people in San Francisco, CA. Involvement in crime, either as a victim or perpetrator, was associated with frequent use of the ED. Specifically, being arrested increased one's odds of visiting the ED at all (AOR = 1.53), and visiting the ED four or more times (AOR = 1.65), during the same year. Other significant predictors of frequent (four or more) ED utilization include experiencing medical comorbidity (AOR = 2.57) and self-rated poor health (AOR = 2.01). The authors attributed the association between victimization and repeat ED use to the fact that homeless individuals are exposed to more violence on a daily basis than people with secure housing (Kushel et al., 2002). The majority of ED visits by people in this sample, however, were motivated by genuine medical need (Kushel et al., 2002). This highlights the negative affect of housing instability on one's ability to treat health-related concerns as they arise. While this study considers the relationship between frequent ED utilization and arrest, it does so among a sample with serious housing instability thus limiting its generalizability.

Frank and colleagues (2013) compared ED visits by ex-prisoners in Rhode Island during his or her first year post-release with adults in the general population during corresponding years. Being an ex-offender increased one's risk of visiting the ED for a mental health-related reason by 43%, and for substance abuse by 93%, when compared to their non-justice involved peers. These associations remained significant even after controlling for gender and age. Being older (45 years or older), white, and being re-incarcerated during the study period were each associated with ED utilization within the first two weeks post-release from prison. The authors conclude that better coordination of health services immediately post-release from prison to avoid expensive, repeat utilization of the ED for conditions better addressed longitudinally, and in community-

based and non-acute settings. This step would seem to prevent a majority of ED contacts for members of justice-involved populations, particularly at the sensitive time immediately following release (Frank et al., 2013).

Another study by the same authors (Frank et al., 2014) examined a nationally representative sample (n=154,356) of U.S. adults to explore the relationship between different forms of recent criminal justice system involvement, and hospital and ED utilization. While individuals with past-year justice system involvement accounted for only 4.2% of their sample, this group was responsible for 7.2% of hospital and 8.5% of ED expenditures – rates significantly higher than those for the general adult population during the same time (Frank et al., 2014). Both recent arrest and recent probation/parole supervision were found to independently increase one's odds of visiting the hospital and ED. Additionally, individuals with recent justice system involvement were more likely to report serious psychological distress, communicable disease diagnoses, and substance abuse issues than those without justice system involvement (Frank et al., 2014).

This study partitioned the sample into three criminal justice groups: those with no involvement (n=143,558), recent arrest only (n=4,586), and recent probation/parole supervision (n=6,212). Nearly 48% of the arrest-only subgroup visited the ED in the past year, and 14% were admitted to the hospital. Members of this group also experienced significantly higher odds of past year hospitalization (AOR = 1.35) and utilization of the ED (AOR = 1.81). As a group, the arrest-only subgroup spent the most days in the hospital, visited the ED most often, and had the highest costs associated with treatment when compared to the other two groups (Frank et al. 2014). The relationship between justice system involvement and hospital/ED use was strongest for those with serious

medical needs or psychological issues; and those on Medicaid, Medicare or uninsured (thus presumably lower access to preventative care). This underscores the need for coordinated efforts to address access to care and serious medical need in order to prevent cross-system cycling. Frank and colleagues (2014) urge future research to consider the interaction between recent arrest and utilization of the ED to understand drivers for this specific overlap and important subgroup differences.

Lastly, while research on cross-system involvement is lacking, there is reason to believe that repeat involvement with one system is often accompanied by contact with multiple other public systems across domains. A report by Haynes and Dion (2012) crossed 12 years of administrative data from five different public systems in Pinellas County, FL to identify “frequent flyers” and show the extent of overlap across the following public systems: emergency medical services; health and human services; criminal justice and jail diversion; children and families; and substance abuse and mental health. A key finding was that individuals with “frequent” involvement in one system were more than two times more likely to also interact with one or more other systems during the same period of time, when compared to non-frequent controls (Haynes & Dion, 2012). Across all individuals involved in the criminal justice system in Pinellas County during the 12-year study period (n=109,619), 44.6% also interacted with the emergency medical system. Among only frequent fliers of the justice system (i.e., top 5th percentile of days incarcerated or cost of incarceration), 57.8% were also involved with the emergency medical system.

Looking across the array of literature discussed above which documents a correlational relationship between health, justice system involvement, socioeconomic

status and disadvantage, it is also possible to examine this from a cumulative disadvantage framework. With this dissertation in mind, cumulative disadvantage can be defined generally as the mechanisms for inequality across the lifecourse through which an unfavorable socioeconomic position becomes a disadvantage that produces further limitations or an inability to achieve future relative gains (Dannefer, 2003; DiPrete and Eirich, 2006; O'Rand, 1996). Health risk factors accumulate and intersect with or create pathways into justice system involvement.

This cumulative disadvantage framework dovetails with Robert Sampson's idea of concentrated disadvantage as a precursor to a range of negative life outcomes. Coming from a neighborhood characterized by high levels of concentrated disadvantage is associated with violence, drug use, low birth weight, poor economic self-sufficiency and even diminished verbal ability in children and youth (Sampson, 2002; Sampson, 2008; Sampson et al., 2008). Research also suggests long-term and persistent effects of neighborhood disadvantage on physical and behavioral health even when individuals move away from these areas (Pickett & Pearl, 2001; Sampson, 2008).

As will be discussed in the methods section, the data at hand does not include substantial demographic information such as poverty level, education, housing choices or access to resources. As a result, I was not able to test or otherwise make use of these alternative frameworks. While I did not go into great detail about these perspectives here, I do acknowledge that there are other theoretical lenses through which to view the relationships discussed in this dissertation.

Together, the literature reviewed above speaks to the importance of looking closer at the health issues and health disparities experienced by members of the justice

population including what specific diagnoses are associated with justice system involvement in general, and with an increase in system contacts over time. First, as a group we know the justice-involved population in the U.S. experiences high rates of physical and behavioral health issues. Additionally, individuals with more justice system contacts tend to experience even more physical and behavioral health issues and social conditions like poverty and housing instability than those with fewer justice contacts. In other words, this body of research suggests as criminal justice contacts accumulate that health and social issues tend to get worse, or accumulate, as well.

Also relevant to a study on frequent system involvement, a handful of studies show that while justice system-involved adults tend to utilize public hospitals at a higher rate than their non-involved peers, the overlap of arrest by police and utilization of the ED is a particularly important cross-over to consider going forward as this may represent even more pronounced need and disadvantage. Frequent ED utilizer populations, on which there is a large body of research, share many important characteristics with adults frequently arrested, incarcerated and cross-system involved. Guided by this body of work, the current dissertation sought to dig deeper into the factors associated with frequent arrest and contact with the ED including key diagnoses to consider, offense types that encourage cross-system cycling, and general patterns and dimensions of this form of system overlap.

## CHAPTER 3: METHODOLOGY

### **Purpose of the Current Study**

The overarching goal of the current study is to gain a deeper understanding of the patterns and dimensions of frequent cross-system involvement or repeat cycling between the criminal justice and public health systems, in Camden New Jersey. Specifically, the overlap of arrest by police and contact with the ED will be examined. A secondary goal is to illuminate what factors work together to encourage or differentiate between various patterns of cross-system cycling.

This study makes many novel contributions to the body of literature on the health of justice-involved populations; and presents advantages over prior research on frequent cross-system involvement, of which there is very little. For one, while criminologists are aware that health is often worse for justice-involved people, studies typically focused on small samples of incarcerated or previously incarcerated people (Binswanger et al., 2009; 2010; 2012). Very few have looked at health disparities within a larger, more general group of offenders at the early (arrest) stage of justice system involvement; and even fewer describe reasons for ED contact among this population (McConville et al., 2018). Furthermore, the focus is often on behavioral health and not physical health and comorbidity. Second, this is among the first studies to look at the particular intersection of arrest and ED contact. Both prior studies on this overlap, however, have found it to be a meaningful iteration of cross-system involvement because it brings together two “systems of last resort” and may represent a particularly pronounced form of vulnerability (Frank et al., 2013; 2014). This dissertation is also among the first to explore frequent cross-system cycling in general (Haynes & Dion, 2012; Milgram et al.,

2018). Prior work on frequent cycling typically takes the very top end of a cross-system involved population and describes it in more general terms. In this study, I will thoroughly describe (with qualitative and quantitative data) various patterns of cross-system cycling including what specific health and justice-related issues accumulate along with the number of arrests or ED contacts.

The following research questions are posed, progressing from general to specific toward the goal of understanding drivers and defining characteristics of frequent cross-system cycling. Hypotheses center around what specific (targetable) factors predict different patterns of contact with both systems, thus digging deeper into the mechanisms that underlie the most problematic patterns of cross-system involvement. Qualitative research questions will also be posed to service providers in the community in order to understand the influence of factors not captured in the quantitative data. Recommendations for programming and policy around cross-systems involvement will also be developed during the qualitative interviews.

### **Research Questions and Hypotheses**

The first research question relates to the overall relationship between arrest and ED use for a range of health-related issues. While criminologists are aware that health is often worse for justice-involved people, many of these studies focus on small samples of incarcerated or previously incarcerated people (Binswanger et al., 2009; 2010; 2012). Very few have looked at health disparities within a larger, more general group of offenders at the early (arrest) stage of justice system involvement; and even fewer describe reasons for ED contact among this population (McConville et al., 2018). In addition to these contributions to the field, this step also lays the foundation for

subsequent comparisons between individuals with increasing rates of arrest and the general arrest sample.

**RQ1** Among individuals who visited the ED at least once between 2010 and 2014, what health issues were more prevalent among those who were also arrested compared to those who were not arrested during the same period of time?

**H1** More arrestees than people who were not arrested will visit the ED for not only substance abuse and mental health concerns, but also chronic and communicable physical conditions and health-related issues linked to homelessness, lack of access to primary/preventative care, and/or a higher-risk lifestyle (Binswanger et al., 2009; 2010; 2012; McConville et al., 2018).

In order to determine what patterns of cross-system involvement exist for this sample (i.e., arrest and ED contact), separate trajectory models for arrest and ED contact must first be run. Membership in these single-system trajectories will then be brought together to assign cross-system involved individuals to joint patterns. A thorough description of trajectory modeling will be provided below; but the focus of this study thus description of the results will be on the joint groups that were formed by bringing together these individual trajectories.

**RQ2** What distinct arrest trajectories, or longitudinal patterns of arrest, exist for the total sample over a 5-year period?

**RQ3** What distinct trajectories of ED utilization, or longitudinal patterns of ED contact, exist for the total sample over a 5-year period?

Next, individual trajectories are brought together to form joint trajectory groups for all cross-system involved individuals. This allows for an understanding of the nature

of the overlap between these two systems (i.e., arrest and ED contact), like how many people contact both and at what “level”; as well as what factors work together to encourage different forms of cross-system involvement. Research questions around joint trajectory group membership seek to uncover drivers of frequent cycling and how the most problematic patterns of cross-system involvement differ from those characterized by fewer system contacts.

**RQ4** What is the relationship between arrest trajectories and ED use trajectories during the same 5-year period of time?

**H2** Members of “frequent” arrest groups will be more likely to belong to trajectory groups characterized by “frequent” ED utilization than to groups characterized by more sporadic contact with the ED (Haynes & Dion, 2012).

**RQ5** What factors predict **joint** trajectory group membership, or cross-system involvement?

**H3** Experiencing mental illness during the study period will predict frequent cross-system involvement. Specifically, ever receiving a diagnosis at the ED for a serious mental illness (i.e., ‘schizophrenia and other psychotic disorders’), drug- or alcohol-related issues, a mood disorder (i.e., bipolar, depression), and co-occurring mental illness and substance abuse will predict membership in a frequent arrest/frequent ED joint trajectory group (Frank et al., 2013; 2014; Fovet et al., 2015; Harding & Roman, 2017; Kushel et al, 2002).

**H4** Any diagnosis of a chronic physical health condition during the study period will predict membership in a frequent arrest/frequent ED joint trajectory group. Receiving diagnoses for multiple (three or more) chronic health conditions

during the study period will be a stronger predictor than a chronic condition experienced alone (Kushel et al, 2002; Frank et al., 2014).

The next research questions work toward examining the relationship between poor health and crime among a subsample of young adults. Using an age-restricted sample of 18 to 22-year old's allows one to naturally control for time on the street as well as many confounding factors that accumulate as people age (e.g., worse). These steps also highlight what issues are more prevalent among individuals with more frequent system contacts who are younger in age, thus what factors associated with cross-system involvement could potentially be targeted earlier in time/one's life.

The steps taken to answer RQ2 and RQ3 (i.e., uncovering distinct trajectories) were repeated with this group of young adults who were 18 years of age in 2010, entering the adult system for the first time at the beginning of the study period. Analyses with this young adult subsample explore the unique impact of visiting the ED during the first few years of one's adult life on one's trajectory through arrest during the same period. I also look at the impact of being arrested during this important time on one's trajectory through the ED as a means of exploring potential reciprocity of system contact.

**RQ6** For a subsample of young adults, what distinct arrest and ED use trajectories exist, and how do these trajectories compare to those for the full sample?

**H5** Despite their younger age, this group does follow a homogenous path through arrest or the ED over time. Distinct trajectory groups are therefore expected to emerge.

The next research question is qualitative in nature and posed to service providers in the Camden community in order to supplement responses to the quantitative research

questions presented above. Specifically, answering RQ1 through RQ5 will generate trajectory groups and determine what factors were predictive of various forms of cross-system involvement. Correspondingly, RQ7 will help to validate these groups and their real-world utility by adding richness to group descriptions with information on factors suggested by providers not captured in the quantitative data. Related to RQ6, providers were also asked for insights into the role of age and time-ordering of system contacts.

**RQ7** When presented with the trajectories that emerge from quantitative analyses, do service providers feel they “ring true” and reflect their real-world experiences or observations? Are there any factors not included in the quantitative data that could help better describe or differentiate between groups?

### **Overview of Quantitative Data**

The quantitative data are drawn from an integrated dataset that contains records of all ED visits across the four major hospital systems in Camden, NJ, crossed with records of all arrests made by Camden County Police (CCPD) in Camden City during the same five-year period of time (2010 to 2014).

Each data system (hospital ED and police) contributed demographic and descriptive information. Data from hospital records obtained for the current study include the consumer’s age at the time of ED contact, gender, dates of admission from and release to the ED, and diagnostic codes assigned during the ED visit (first three to capture reason(s) for admission). Arrest records contributed by Camden County Police include the date of the arrest, primary charge code(s) assigned by the arresting officer, statute description, and arrestee demographics (i.e., age, gender, race/ethnicity).

This data infrastructure was developed by The Camden Coalition of Healthcare Providers (“The Coalition”) in 2010 as a step toward better understanding how adults in Camden navigate their local healthcare environment (Gross et al., 2013). These information-sharing agreements are extremely valuable but still quite novel as few jurisdictions share data across hospital systems, and even fewer bring together data from health and criminal justice institutions. Linking information in this way allows for a more comprehensive picture to emerge of the relationship between public health and justice system involvement for members of a community. Integrated data can also be used to demonstrate the extent of this overlap (i.e., size of shared population), and what factors work together to encourage different forms of cross-system involvement. The Coalition’s formal process for sharing data with an outside researcher was piloted with the current study, making it among the first to use these important integrated data. For a more detailed description of the methods used by The Coalition to develop the hospital claims and police integrated database, see Gross et al., 2013.

Cases in the master hospital claims dataset (which includes children and adults) were matched to police records by staff at The Coalition on birthdate, social security number, phonetic first name(s), and last name. This information was removed after the matching process, and a random ID number was assigned to each unique individual (and age coded as age in years instead of birthdate<sup>2</sup>). Only the adult sample is analyzed in the current study (i.e., must have turned 18 in 2010 to be included). Data were cleaned and checked for accuracy by staff at The Coalition prior to sharing. If a variable was deemed

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<sup>2</sup> To maintain confidentiality, before the age variable was created, birthdate was replaced by a randomly chosen birthdate + or – six months (after all juveniles were removed from the sample). Then the age variable was created based on this obscured/not exact value.

unreliable by data managers at The Coalition (like the homelessness flag and insurance indicator, for instance, which will be discussed later), it was not used for this study. Key data on each system contact was then aggregated by ID number to create a file in which unique individuals occupy a single row containing information on each system contact over the total five-year period (i.e., data were transformed to wide format).

### *Overview of Quantitative Samples*

The total sample includes all adult men and women (18 or older) who appeared in the integrated data at least once between 2010 and 2014. This means the full file contains records for any adult with one or more ED visit or one or more arrest in Camden, NJ during the 5-year study period. The total sample (N=424,845) thus represents system-involved individuals only and does not include any members of the “general population” (i.e., people with no system contacts during that time).

Because of the nature of each research question, sample sizes vary across analyses. All subsamples are drawn from the main quantitative data file of 424,845 system-involved adults mentioned above. While sample size for each analysis is indicated throughout the discussion of methods and results, outlining these differences in one place is useful for clarity.

For the first research question (RQ1) a sample is analyzed of all adults that visited the ED at least once during the study period (N=414,942) split between those with and without arrest. For each trajectory model, only individuals who contacted a given system are included in the analysis. There was no justifiable reason to overwhelm the model with thousands of extra cases just to produce a zero-order group. In the case of arrest, this would have meant including more than 350,000 non-arrested people in the statistical

model. Group-based modeling for arrest (RQ2) therefore includes 26,626 individuals; and ED use (RQ3), the same 414,942 as for RQ1. When joint group trajectory membership is the focus (RQ4 & RQ5), the sample includes only the 16,723 individuals with one or more contact with both systems (arrest and the ED). Lastly, to RQ6, a subsample was drawn from the full adult sample of men and women who were 18 years of age in 2010 regardless of the year in which they first entered the data (n=8,625). Like with the full sample, only young adults with arrests are included in the arrest trajectory model (N=986); and only young adults that visited the ED are included in the ED trajectory model (N=8,242). Again, this will be made clear throughout the results section as models are discussed in detail.

### **Overview of Qualitative Data**

The qualitative portion of this dissertation (RQ7) includes semi-structured interviews with a small but targeted group of service providers in the Camden, NJ community (N=6). Participants were recruited from relevant organizations and programs servicing residents of the Camden community around health, substance abuse, reentry, homelessness, or wrap-around/comprehensive care. Service providers represent organizations across disciplines and have experience with frequent utilizer populations.

As part of the first phase of recruitment, service providers working at The Coalition were approached via email. People with whom I or members of my committee have worked in the past were also contacted via phone or email. A short description of this research project including the reason for qualitative interviews and a rough overview of questions to be asked was attached to each request. These “beginning seeds” of the sampling process, whether they agreed to participate or not, were also asked for the

names of other potentially eligible providers. These referrals were the source of all qualitative participants (i.e., a snowball sample).

Selection criteria for inclusion in the qualitative portion of this dissertation was as follows: (1) currently works for an agency that provides services to adult residents of Camden, NJ or immediately nearby; (2) professional experience with at least one case in which an individual experienced frequent criminal justice system involvement and/or frequent hospital/ED utilization; (3) some experience providing front-line services to individuals with both justice system involvement and health-related issues.

The qualitative component of this dissertation, including subject recruitment strategies, was approved by Temple University's Internal Review Board (IRB) as a study posing minimal risk to participants. Since the quantitative data are administrative in nature and completely de-identified, no IRB approval was required for that portion of this study. Official IRB Approval of the qualitative interviews only is included as Appendix A. Before each interview, providers were emailed a consent document with a description of the study and contact information should they have questions or concerns. A signature was not required of providers by the IRB because of its 'minimal risk' designation. They were encouraged to maintain the consent for their records.

### **Quantitative Measures**

Hundreds of variables are available in the raw integrated data, especially from the ED (i.e., individual diagnoses). From these a number of relevant variables were drawn/derived in order to answer the research questions above. The description of measures to follow begins with an overview of the specific variables used to form the trajectory groups. Key covariates and predictors are then discussed beginning with

demographics, then indicators of criminal justice system involvement (from the arrest data), then measures of physical health and behavioral health (from the ED data). A table listing all variables used in analyses is included as Appendix B.

### ***Description of Outcome Variables for all Trajectory Models***

Trajectory modeling requires a count outcome variable measured at evenly spaced intervals over time. The following measures were used as outcome variables for the group-based trajectory models run with the full adult sample (RQ2 for arrest, RQ3 for ED use) and the young adult subsample (RQ6 for arrest and ED use). Different indicators of ED use and arrest were used in descriptive analyses and will thus be discussed in more detail later during the description of covariates.

ED utilization for the group-based trajectory models were measured as a count of the number of ED contacts that took place between 2010 and 2014. Counts are measured at six-month intervals across the five-year study period. Each person therefore has a total number of arrests for each six-month period (or “bin”) across five years of data for 10 total observation points<sup>3</sup>. In the hospital data system, ED contacts are recorded regardless of whether services were ever received and/or that person was actually seen or admitted – so should be interpreted as contact with the ED not necessarily ED or hospital admissions. One important facet of ED use to keep in mind throughout this dissertation – not every ED contact should be perceived as help-seeking behavior. Individuals are often

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<sup>3</sup> To clarify, counts in the current data are summed across each six-month period or “bin”. The data therefore do not capture the exact temporal ordering of events within each six-month period. For instance, the data could show that person A visited the ED 3 times and was arrested 2 times during the first six months of 2010; but the data would not show in what order the ED visits and arrests took place during that time. Trajectories were based on counts summed across each six-month period over the course of five years’ time (10 sequential six-month periods) – so rough temporal ordering can be established over the full 5-year study period.

brought into the ED against their will or without their consent –because they were found unconscious, were hurt at work or school, experienced a health issue while incarcerated, were brought to the ED by police, among other reasons.

Arrest was measured as a count of the number of official arrests handled by the Camden County Police Department between 2010 and 2014. Like with ED use, arrests were measured for the purpose of trajectory analysis at each six-month point across five total years (again, ten different observation points per person).

Arrest was chosen over incarceration as the operationalization of criminal justice system involvement for a number of reasons. First, arrest represents a brief form of justice system involvement that could take place countless times during a five-year period. In other words, an extensive pattern of arrest could be captured during the relatively short study period for an individual that experiences this behavior, more so than a pattern of incarceration which would entail time spent outside of the community thus no longer in these data. Second, data on arrestees represent the widest range of criminal behavior – anything from summary offenses to felonies can, and often do, begin with an arrest. Using this as the target measure of justice system involvement allowed for variation in the extent of criminality and types of criminal behavior represented among members of the sample. Prior research has also suggested that arrestees face significantly higher odds than even those on probation and parole of contacting the hospital and ED suggesting this is an important group on which to focus (Frank et al., 2013; 2014).

### ***Description of Covariates***

The variables included in these administrative data represent a comprehensive range of demographics, physical and mental health-related conditions and reasons for

arrest. These measures were used to describe and distinguish between trajectory groups that emerge, both as descriptive variables and predictors in regression models. Again, all variables used in this study are listed/described in a table included as Appendix B.

### *Demographics*

Age, measured in years, is recorded at the time of an individual's first contact with either system. For instance, if someone contacted the ED or police in 2011 when they were 25 years old (plus or minus six months), their age remained as 25 for any subsequent reappearance in the data, even if it happened in years 2012, 2013 or 2014 when that individual was no longer 25. This means age does not increase with time and instead represents a person's age at their first appearance in the integrated data.

To account for gender, analyses include a dichotomous measure for male (yes/no). Gender is represented as a dichotomous measure of male/female, with everyone in the data assigned one value or the other. This reflects the way in which the data were collected/passed on (i.e., no 'other' category). Like age, this is a static measure of a person's gender at the time of his or her first appearance in the data.

Race is either self-reported or filled in by hospital staff or police (visual determination). The categories included in the original data are black, black Hispanic, white, white Hispanic, Asian/Pacific Islander, American Indian/Alaskan, multiple, other, missing, and unknown. For analyses, three dichotomous (yes/no) measures were used to capture black non-Hispanic, white non-Hispanic and Hispanic. The Hispanic variable groups the black Hispanic and white Hispanic categories so can be interpreted as 'any Hispanic'. No other indicator of ethnicity is included in the data. 'Black' and 'white' should be interpreted as black non-Hispanic or white non-Hispanic.

### *Criminal Justice System Involvement*

For descriptive purposes, a number of variables were created to measure presence and frequency of arrest. This includes dichotomous measures of any arrest during the study period, and during each individual year; a count of arrests over the total five-year period; and whether a person was arrested five or more times (yes/no).

The criminal charge(s), or UCR codes associated with each arrest are included in the raw integrated data and were collapsed into categories by The Coalition. Categories included as variables in the current study are disorderly conduct, drug offenses, property crimes, prostitution, violent crimes, and weapons offenses. The other offense categories of traffic violations, non-violent sexual crimes, arson, public order and administrative/criminal justice charges are not examined here – either because so few people were arrested for a given offense or because it was outside of the scope of this dissertation. Misdemeanor and felony arrests are grouped together in each category so do not capture degree of seriousness.

Disorderly offenses include minor and non-violent things like nuisance offenses, open container of alcohol in public, conspiracy to commit a crime, loitering, and being in a public park after dark. Drug offenses range from use to possession to manufacturing and sales. Property crimes relate to offenses like vandalism, damage to property, selling/receiving illegal goods, breaking and entering, and fraud. Prostitution charges include all codes related to soliciting and engaging in sex work.

The violence measure, which was based on groupings of statutes created by The Coalition prior to receiving the data, comprises a wider range of offenses than is typical (i.e., not just murder, rape, aggravated assault and robbery). The charge types include

aggravated assault, simple assault, assault on a public official (e.g., law enforcement, EMS), carjacking with threat of injury, kidnapping/criminal restraint, robbery, aggravated sexual contact, sexual assault/rape, assault with a firearm, threatening violence, bias intimidation, domestic violence, homicide, murder and manslaughter. It should be noted that all of these offenses are serious, violent and person-oriented; but not all are felonies. This categorization also does not directly follow the traditional UCR grouping of violent crimes (i.e., murder and nonnegligent manslaughter, rape, robbery, and aggravated assault) but the majority of charges in this category are for offenses in the UCR grouping.

Weapons offenses are separate from violent crimes because they are assigned when a weapon is present or sold/obtained illegally, regardless of (but also including) whether it was used to perpetrate a crime. These charges often occur together but represent different issues.

Dichotomous measures were created to indicate any arrest for each of these offense types across the five-year study period. For disorderly, drug charges and violent crimes, a count measure was also created to capture the number of arrests for that particular offense. Dichotomous measures were also created to indicate the presence of multiple (3 or more) arrests for that offense type (e.g., three or more drug charges, 1 (yes) on this measure of multiple drug charges).

### *Emergency Department Contact*

Like with arrest, variables were created to measure presence or frequency of ED contact. These descriptive measures include the following: a dichotomous measure of whether a person ever visited the ED during the study period, whether they visited during each individual year, and whether they visited five or more times in five years; and a

count of ED visits over the total five-year period. Variables were also created from the hospital claims data to reflect the presence of different health issues at the time of an ED contact. This means dichotomous measures of whether an individual ever visited the ED for a certain reason; and counts of the number of ED contacts for that particular issue.

During the study period (2010-2014), hospitals were using ICD-9 codes to enter medical claims data – of which there are more than 14,000. Clinical Classifications Software (CCS) is a grouping scheme applied to ICD-9 data that collapses individual ICD-9 codes into broader but clinically meaningful categories (<https://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>). This software was developed through the Healthcare Cost and Utilization (H-CUP) Project sponsored by the Agency for Healthcare Research and Quality (AHRQ), which is focused on providing data tools so researchers can better navigate hospital claims data and health policy issues. These categories were created and subsequently verified by practitioners and researchers alike.

The integrated data groups diagnoses using the CCS grouping scheme. For analyses, I mostly used diagnoses at the level of ‘CCS category label’ which seems to be one step less granular than individual diagnoses but not as broad as categories at ‘CCS level 1’. Categories were either included alone (e.g., abdominal pain, STIs) or combined with others to produce broader composite measures (e.g., chronic conditions, substance abuse). In one case only, a CCS category label (mood disorder) was split into two separate variables (bipolar and depression). The table in Appendix B specifies what CCS category a particular diagnosis-related variable represents.

When an ED contact takes place, diagnosis codes are generated to reflect the issues addressed at that visit. These codes could come from self-report (i.e., what patient

cites when signing into the ED) or assigned by a healthcare professional during the visit. My data includes only the first three diagnosis codes attached to a given ED contact. This was done to restrict diagnoses to only/mostly those associated with one's reason for that ED visit. Including all diagnoses assigned during an ED visit could mean including screening or administrative codes or those associated with past diagnoses. This convention was recommended to me by data managers at The Coalition as a feasible way to exclude the majority of extraneous codes not related to the ED visit at hand. The mean number of diagnosis codes assigned at the ED for the full sample was 3.26 (range 1 to 65). The majority of individuals received one or two diagnoses at the time of an ED visit.

Variables were generated from the hospital claims data to indicate the presence of certain physical and mental health issues using the diagnosis codes assigned at the time of an ED contact. In some cases (indicated below), a count measure was included and/or a dichotomous indicator of multiple ED contacts for the same condition. Again, there are an overwhelming number of health-related indicators available in the raw hospital data. Because it is not possible to include them all in any descriptive effort, measures were carefully selected to represent the range of issues, from minor to severe, that justice-involved and cross-system-involved individuals might experience at any point in their adult lives. Each measure generated from the hospital claims data for analyses is also described in more detail below.

### *Physical Health*

First, abdominal pain, one of the most common reasons for ED use in the United States, is coded when an individual self-reports general pain in his or her abdomen (Weiss et al., 2014). This is a very general diagnosis category included in the 'symptoms;

signs; and ill-defined conditions and factors influencing health status' category of ICD-9 codes. That being said, abdominal pain is not always a minor complaint and could indicate something more serious like a somatic reaction to stress, appendicitis, unknown pregnancy, cancer and the like (Velissaris et al., 2017).

Next, there is not a common list of chronic conditions that all researchers or practitioners refer to when discussing chronic health concerns. Each study, policy or website tends to utilize a different grouping of conditions. For this study, I drew from a number of sources to compile a list of relevant chronic physical health conditions to include in this measure including the Centers for Medicare & Medicaid Services website ("Chronic Conditions", 2019; Kushel et al., 2002; Raghupathi & Raghupathi, 2018). In sum, my measure includes chronic physical health conditions that (1) represent something long-term and significant that an individual would require regular medical attention to address in order to maintain good health, and (2) for which I have the appropriate data (i.e., issue not grouped with other diagnoses as a CCS category). The chronic condition variable included in this study represents the presence of one of the following conditions: arthritis, asthma, cancer, chronic kidney disease, chronic obstructive pulmonary disease (COPD), diabetes, hepatitis, HIV, and hypertension. A variable was also created for the presence of multiple ED visits (3 or more) to address any chronic condition.

Skin conditions were measured with binary variables that represented any ED contact, and the presence of multiple (3 or more) ED visits, for a skin-related issue. Specifically, this CCS category grouped skin infections, other inflammatory conditions of

the skin, ulcers/abscesses of the skin, and “other” skin diseases (i.e., everything in the broader CCS level 1 category ‘diseases of the skin and subcutaneous tissue’).

The variable representing any ED contact for dental comprises all diagnosis codes related to teeth, or those labeled “teeth dx” under “disorders of the teeth and jaw”. For the dichotomous measure of multiple ED contacts for dental, a yes (1) means an individual visited the ED three or more separate times to address a tooth-related concern.

Another very common reason for ED admission is a general injury. The variable used in the current study groups the following issues from the hospital data into a common variable for injury: superficial and joint injuries, fractures to all bones except the skull, crushing injuries, intracranial injuries, and “other injuries from external causes” (except spinal cord injuries). A dichotomous variable measures any injury during the total five-year period. A variable for 3 or more injuries measures whether (0/1) an individual visited the ED for three or more different injuries during the study period. A count of the number of injuries over time was also included as a descriptive variable. A fracture to the skull is coded separately as a skull-related injury (0/1).

As was mentioned above, hospitals used ICD-9 codes to enter medical information during the study period (2010-2014) which did not include a clear indicator of drug overdose. There are two separate categories of poisoning in the raw hospital data (‘ecodes: poisoning’ and ‘poisoning’ under the category ‘injuries and poisoning’). Neither of these imply much about the intent behind an overdose (i.e., whether it was on purpose or accidental). To be inclusive, all poisoning codes are grouped into a variable labeled poisoning/overdose; but this should not be interpreted as illicit drug overdoses exclusively (Wang et al., 2013). This dichotomous measure is therefore not a proxy for or

measure of substance abuse necessarily. A dichotomous variable was also created to capture the presence of multiple (3 or more) ED contacts for a poisoning or overdose during the study period.

Sexually transmitted infections (STIs) include all codes in the hospital data corresponding to ‘sexual infections (not hepatitis or HIV)’. A measure represents whether (0/1) an individual visited the ED for any STI during the five-year period.

The wounds variable represents whether (0/1) an individual ever contacted the ED to address an open wound in the head or extremities (i.e., anywhere on the body). It is my understanding that this could be a recent wound, or an infection or complication associated with a previous wound/injury; and may be combined with codes to indicate where the wound was located and/or its approximate cause.

### *Behavioral Health*

Behavioral health issues comprise all ICD-9 codes included in the raw data file that represent “mental disorders” or mental health conditions. A variable was also created to represent ED contact for any mental illness other than substance abuse. This measure groups all of these codes (other than alcohol- and drug-related), or the following categories: adjustment disorders, anxiety, ADD/conduct disorder, dementia, developmental mental illnesses, all forms of bipolar disorder, depression, all personality disorders, schizophrenia and psychotic disorders, suicide, history and screening codes, and miscellaneous mental health concerns like eating disorders and pathological sleep issues. Variables were also created for the following individual diagnosis categories: anxiety, bipolar (all types), depression, schizophrenia (and other psychotic disorders), suicide (which groups ideation and attempts), and substance abuse (alcohol- and drug-

related disorders together). Measures indicated any ED contact for a given diagnosis category (0/1), multiple (3 or more) ED contacts for a given reason (0/1), and a count of number of visits for a given mental health-related issue across the five-year study period.

Lastly, dichotomous variables were created to measure the presence of multimorbidity including three or more different chronic physical health conditions; co-occurring mental illness and substance abuse; chronic health conditions and substance abuse; and chronic health conditions with mental illness and substance abuse.

### **Missing Quantitative Data**

The only “missing” data related to demographics; and came from the hospital side. There was no indication of missing or incorrect arrest data. Individuals involved with either system more often are less likely to have missing data – because presumably additional contacts provide the data managers at The Coalition an opportunity to obtain/fill in the missing information.

There were three different “ages” assigned to a disproportionate number of individuals in the hospital claims data – 108, 109 and 122.5 years old. Because very few people in general reach 100 years old, it seemed incorrect for 413 people to report these advanced ages. After some discussion with The Coalition, we determined that these values must correspond to a mock or fill-in value assigned at one or more of the hospitals when they could not ascertain a person’s true date of birth. Taking these to be “missing” values, and to be conservative, individuals reporting the ages of 108, 109 and 122.5 (413 total people) were excluded from all analyses. All other ages were kept in.

One person was missing on gender. This individual was only present in the hospital data, so was not included in any of the arrest trajectories nor joint trajectory

groups. Interestingly, this person was diagnosed with a “female issue” at the ED during the study period, so was assumed to be female when describing the ED trajectories.

A total of 29,205 people (6.9% of the total sample) including 637 young adults (7.4% of the young adult subsample) were assigned a value of ‘missing’ or ‘unknown’ on race/ethnicity. Again, missing values came from the hospital data so did not impact the arrest sample thus the joint trajectory groups. Because these missing values had a minimal impact on analyses (only affected ED trajectories), no imputation of missing values was done.

There were no other “missing” values in these data. An empty cell was therefore always taken to mean that someone did not visit the ED for that reason or get arrested for that charge (i.e., assume a 0). There was no reason to believe that an empty cell in terms of diagnosis or charge type meant data were missing for any other reason.

### **Statistical Analysis Plan**

Multiple statistical tools were employed to address the research questions outlined above. First, to answer RQ1, chi-square and ANOVA were used to determine the extent of between-group differences on demographic, health- and justice-related factors for those that visited the ED but were not arrested, compared to those that visited the ED and were also arrested during the same period of time. To overcome type 1 experiment-wise error, Bonferroni correction will be employed. Specifically, the p-value of .05 will be divided by the number of pairwise comparisons in each table in order to arrive at a more conservative p-value for determining statistical significance.

### ***Group-Based Trajectory Modeling & Model Selection***

Next, group-based trajectory modeling (GBTM) was used to answer RQ2 and RQ3 which asks what distinct pathways existed for the total sample through arrest (RQ2) and the ED (RQ3) over the five-year study period. GBTM is a form of growth mixture modeling that charts “developmental trajectories”, or the evolution of an outcome over age or time, and assumes no within-trajectory variation (Nagin, 2005). This methodology assumes a heterogeneous population in which distinct subgroups exist, each with a unique longitudinal path through the outcome of interest – like an increasing pattern, decreasing, steady, and so on. Analyses yield statistically robust groups that are easily understood by non-research communities. Other methodologies like hierarchical linear modeling (HLM) and latent curve analysis (LCA) also examine heterogeneity in longitudinal data (Raudenbush, 2005). Unlike GBTM, however, these methods assume the population follows a common trajectory through a particular outcome over time and statistically account for individual variation from this path over the study period (instead of yielding approximations of distinct groups). GBTM is an appropriate methodology to answer RQ1 and RQ2 because we assume a form of population heterogeneity that is best captured by multiple, distinct groups and not by individual-level variation from a common trajectory (Brame et al., 2012). I also anticipated meaningful differences in terms of the shape and pattern of longitudinal system involvement.

The plugin developed by Jones and Nagin (2013) to calculate group-based trajectory models in STATA was utilized (*traj* command) which produces statistics that can assist in model selection. The outcome variable is counts of either arrests or contacts with the ED, during each six-month period over five years. To account for the abundance

of zeros in these counts – more so than those expected by a straightforward Poisson model – zero-inflated Poisson (ZIP) models were used (Nagin, 2005; Jones & Nagin, 2013). All zero cases were removed before running each trajectory model in order to restrict the data to only people involved with each system. Due to the wide range of ages in the full sample, age was included as a time-stable covariate in the trajectory models run with the full sample but not the young adult subsample models.

A challenging but fundamental step in GBTM is selecting the appropriate number of trajectory groups to fit one's data. While much of the decision is subjective, Nagin (2005) provides a detailed description of the statistical tools available to validate model and group selection. In the current dissertation, these steps were followed in pursuit of statistically reliable final models that captured distinct and interpretable group differences in the data. The same steps were followed for all of the models run in this dissertation (i.e., arrest and ED for the full and young adult samples).

First, a series of group-based trajectory models were run, beginning with a two-group solution and incrementally increasing the number of groups specified in each model until the BIC value (Bayesian Information Criterion) stopped “improving” or getting lower. All groups were set to follow a cubic function at first. A short list (usually 3) of good-fitting models were extracted from these iterations based primarily on which reported the lowest BIC values. In the next set of models, individual trajectory groups that are not significant at a cubic function was permitted to follow linear or quadratic polynomial functions instead. Each combination of number of groups and shape of each individual trajectory constitutes its own model, and BIC values were compared across these models to select the next short list of best-fitting.

Once two or three “best” models were selected from these steps, additional model diagnostics generated for each and compared across to determine the final solution (i.e., which had the “best”). To begin, posterior probabilities of membership measure an individual’s likelihood of assignment to each trajectory group in the model based on his or her behavior across the study period (Nagin, 2005; p.79). Perfect or ideal assignment would result in a posterior probability of 1 for each person in the data, for his or her assigned group. The maximum likelihood rule is applied here, which automatically assigns individuals to the group for which their posterior probability of membership is highest, or closest to 1. These individual-level probabilities were averaged across members of each group and weighted by group size to arrive at group-based average posterior probabilities of assignment, or AvePP. To determine if the final models are adequate, I apply Nagin’s rule-of-thumb that states a “good” solution reports an AvePP of .7 or higher for all groups (Nagin, 2005).

Next, the odds of correct classification (OCC) is a statistic that divides the likelihood of correct assignment to a particular group averaged across members, by the odds of correct assignment to the same group based on random chance (Nagin, 2005). If the final model is not better than random chance at assigning individuals to a particular trajectory group, the OCC for that group would equal 1 (Nagin, 2005). Larger OCC values (more than 1) indicate better accuracy in terms of group assignment. Nagin (2005) suggests that an adequate cut-off for acceptable/high assignment accuracy is an OCC greater than or equal to 5.0 (or a 5 in 1 chance of correct assignment, 50% of members were correctly classified) for all groups (p.89).

This dissertation began with a plan to bring trajectories for one outcome together with trajectories for the other to form joint trajectory groups. For this reason, the size of each trajectory is important to subsequent analyses. A rule was applied that every final group must comprise at least 1% of the total sample for that trajectory model.

In addition to inspecting the BIC, the best-fitting model also needed to satisfy the rule of parsimony and yield groups that are justifiable. That is, each final model must include the adequate number of groups to capture true group-based heterogeneity and contribute meaningful information; but not so many groups so to be overly complicated or redundant. All final models were graphed to visually inspect the shape of each trajectory group. Specifically, the mean number of system contacts for each trajectory group, at each six-month point, was graphed for all final trajectory models.

Trajectory groups that emerge from the final GBTM models were subsequently described using ANOVA and chi-square analyses to look for between-group differences. Specifically, ANOVA applies to continuous variables like age, number of ED visits over 5 years, of number of arrests; and chi-square compares categorical variables between groups like gender, ever arrested, or ever diagnosed with a mental illness. Logistic regression dug deeper into trajectory group differences where appropriate, using trajectory group membership as a categorical variable in each of these analyses. These steps determine what factors related to demographics, ED use, physical and mental health, arrest and offense type differentiated each group from the others; and what between-group differences are statistically significant. These analyses are not only descriptive but also serve to further demonstrate the validity of the trajectory groups that emerge and their ability to capture true group differences present in the data.

### ***Cross-Classification Analysis***

The next research question (RQ4) asks about the relationship between membership in arrest and ED trajectory groups as a means of exploring the association between frequent arrest by police and frequent utilization of the ED. Cross-classification analysis were done to determine whether more members of a frequent arrest group are also in a frequent ED trajectory than would be expected by chance. Conditional probabilities were also calculated and visually represented in a stacked bar graph, indicating each cross-system involved individual's chance of being in an ED trajectory conditional on his or her pattern of arrest. Because arrest and ED trajectories use independent samples, conditional probabilities are calculated using proportions from a basic cross-tabulation.

Dual trajectory modeling, while possible with these data, would have added substantial complexity to models that already included a large and rather unprecedented number of people (more than 400,000 in the full sample). Each individual trajectory model also only includes system-involved people, so analyzed samples of different sizes. Nagin (2005) advises that, in cases where AvePP values are high, a cross-classification analysis can be used to demonstrate comorbidity of behaviors over time; and this methodology has been used by other scholars to bring together two different trajectory models (Ward et al., 2010).

### ***Predictors of Joint Trajectory Group Membership***

The next research question (RQ5) explores what factors predicted frequent cross-system involvement over more sporadic cross-system involvement. Variables were created to represent membership in each joint or cross-system trajectory group. For

instance, the joint group “high arrest/high ED” would represent people (1=yes) in the high arrest group and the high ED group. These steps mirror the methods used in a recent article by Mulford and colleagues (2016) who created similar joint trajectory groups then predicted membership with other factors.

Binary logistic regression models were run to demonstrate the ability of a range of factors to predict membership in each frequent joint trajectory group when compared to a joint trajectory representative of low-level cross-system involvement. First, H3 and H4 hypothesize that receiving a diagnosis of schizophrenia, substance abuse, a mood disorder, co-occurring mental illness and substance abuse, and chronic physical health conditions would each predict frequent cross-system involvement. Predictors for this model include binary variables to represent any diagnosis given at the ED for these issues during the study period.

An additional set of binary logistic regression models were run to predict frequent cross-system involvement with factors that emerge from the descriptive analyses and interviews with providers. The factors that seem to exert an important influence on frequent cycling include substance abuse, co-occurring mental illness and substance abuse, physical chronic conditions, drug arrests and exposure to violence. With the exception of dual diagnoses which was a binary variable, predictors in these models are continuous representing an increase number of ED contacts or arrests for these issues. Any ED visit for depression (binary) was also included as a covariate as depression has a strong relationship with more frequent system contacts.

### ***Young Adult Subsample Analyses***

Next, to answer RQ6, the total sample was restricted to include only individuals who were 18 years of age in 2010. This allows the data to naturally control for age and factors that accumulate as people age. Restricting the analyses by age also provides a mechanism to dive deeper into describing the constellation of issues individuals may encounter in their youth as they enter the adult criminal justice system. That is, instead of capturing just a random five-year snapshot of an adult's life, this step illuminates issues specific to people experiencing criminal justice and/or public health system involvement during the first five years of their adult life.

Similar to RQ2 and RQ3 discussed in detail above, RQ6 asks what trajectories exist for young adults through both arrest and ED over time. The same methodological steps used to answer RQ2 and RQ3 were employed to address RQ6. Young adult trajectories were also visually compared to those for the full adult sample to look for overall similarities and differences.

### ***Qualitative Interviews & Analysis***

To answer RQ8, semi-structured interviews were conducted with a small, purposive sample of service providers in the Camden, NJ community (n=6) with unique insight into health system involvement by justice-involved individuals. A topic guide to guide discussions is included as Appendix C. While each qualitative research question was posed, the semi-structured nature of the interviews allowed for topics other than those included on the interview guide to emerge as well.

Research questions/prompts, information on the sample and results of the trajectory groups were presented to each provider throughout the interview as PowerPoint

slides on a laptop computer. Conversations were structured around topics in which each provider seemed interested and qualified to discuss. This includes discussion of whether these trajectory groups seemed relatable and familiar, what systemic issues contribute to cross-system cycling, what could be done to assist these individuals, the ideal approach to addressing this particular pattern of behavior, and other topics that arise. All interviews were audio recorded and transcribed.

To analyze the transcripts, a series of steps were followed. First, codes were created to reflect possible responses to the qualitative research question (RQ7). The specific codes that correspond to each research question are noted in Appendix C. Using Atlas.ti software, each transcript was reviewed multiple times and a priori codes assigned. Next, higher-level codes were created to capture broader common themes that emerged across interviews and highlights/important quotes from each provider. Lastly, transcripts were re-read and new codes were assigned inductively when appropriate to capture important but more specific themes.

A full list of codes and counts for each (total N=6) are included as Appendix D. To break this down further, RQ7 asked if any trajectory groups made sense to providers and/or reflected their real-world experiences. This also provided an opportunity for providers to elaborate on the factors associated with different patterns of system involvement. During analysis, I created codes for any direct mention of a specific trajectory group. Codes were also included for each of the following factors mentioned by providers as potential drivers for frequent cycling (either after probing or on their own): access to services, physical health, chronic conditions, substance abuse, mental illness, comorbidity, violence, prostitution, homelessness and poverty.

## **Data Access**

The Coalition granted access to a deidentified copy of hospital claims data crossed with police arrest data. They also provided assistance defining variables, troubleshooting issues and answering questions as they arose.

## **CHAPTER 4: QUANTITATIVE RESULTS**

In this chapter, I discuss the findings of each quantitative analysis organized by quantitative research question (RQ1-6). After a brief description of the total sample, I will describe differences between arrestees and non-arrestees on reasons for ED contact (RQ2). Next, I used group-based trajectory modeling to approximate patterns of arrest (RQ3) and ED contact (RQ4) separately; and described the groups that emerged with a focus on frequent involvement with either system. RQ4 and RQ5 dealt directly with cross-system involvement – first by exploring how likely a “frequent” arrestee was of also belonging to a “frequent” ED group; then by describing the most frequent cross-system involved groups with descriptive and predictive methods. In RQ6, a young adult subsample was analyzed in order to naturally control for age thus better explore time-ordering of system contacts.

### **Overall Description of Quantitative Sample**

The integrated dataset included 424,845 people. As described above, the sample for this dissertation was comprised of adults that visited the ED at least once or were arrested at least once in Camden, NJ between 2010 and 2014. Everyone in the data was therefore system-involved to some extent (i.e., no members of the general population). It is important to note that the individuals represented in the dataset could have a home address outside of Camden and New Jersey; there was no residency restriction applied to

the sample. The intent was to understand the overlap between the systems, which includes anyone visiting the ED or who had been arrested in Camden, NJ<sup>4</sup>.

Table 1 includes basic demographic information and indicators of system involvement for the full adult sample. The mean age across all individuals was 44.5 years (SD=18.7) with a range from 18 to 107. The total sample was 47.4% male, 24.6% black, 60.5% white, and 3.9% any Hispanic. The average number of ED contacts per person across the five-year period was 2.8 visits (SD=5.1), and 2.9 visits for people with one or more ED contact (SD=5.2) with a range from 1 to 464. The average number of arrests for the full sample was 0.2 (SD=1.0); but among individuals with at least one arrest, the mean was 2.5 (SD=3.2) with a range from 1 to 124 arrests. Because the sections to follow include a substantial amount of health- and arrest-related characteristics by specific subgroups within the data, a longer description of the full sample is not included here. For more detail about reasons for ED contact and arrest for the total sample of arrestees, refer to the column in Table 3 labeled ‘TOTAL ARREST SAMPLE’. For a description of the total ED sample, refer to the column labeled “TOTAL ED SAMPLE” in Table 5.

<u>Measure</u>	TOTAL SAMPLE (N=424,845)
Age (years)	44.5 (18.7)
Gender (male)	47.4%
Race (black)	24.6%
Race (white)	60.5%

<sup>4</sup> Because there is large difference in demographics (particularly race) between Camden City residents and those of Camden County at large, tables 1 and 2 were also run with only individuals that were Camden City residents at some point between 2010 and 2014. These descriptive tables are included as Tables A14 and A15 in Appendix K.

Ethnicity (Hispanic)	3.9%
Camden resident	15.2%
Ever ED	97.7%
5 or + ED contacts	13.9%
ED contacts (#)	2.8 (5.1)
	<i>range: 0-464</i>
ED contacts (#) – <i>among those with at least 1 ED contact</i>	2.9 (5.2)
Ever Arrest	6.3%
5 or + Arrests	0.8%
Arrests (#)	0.2 (1.0)
	<i>range: 0-124</i>
Arrests (#) – <i>among those with at least 1 Arrest</i>	2.5 (3.2)
<hr/>	
Percentages (%) represent proportion of group with ‘yes’ on a dichotomous measure. For continuous measures, group means and (standard deviations) are presented.	

**[RQ1] Health Disparities between Arrestees and Non-Arrestees**

First, the current data allowed for a unique exploration of what health-related issues were experienced disproportionately in general by individuals with justice system involvement. The first research question asks about the difference between arrestees who visited the ED at least once, and people who visited the ED but were not arrested during the same period of time, on demographics and reasons for ED contact. Table 2 displays key demographic and health-related characteristics associated with individuals who were arrested and also visited the ED between 2010 and 2014 (N=16,723), and those that visited the ED but were not arrested during the study period (N=398,219). As will be noted in Table 3, 62.8% of the arrest sample (N=26,626) visited the ED at least once.

Chi-square and ANOVA analyses were done to determine significant between-group differences; and Bonferroni corrections applied to the p-value to adjust for type 1 experiment-wise error. With 35 comparisons in the table, this meant following a p-value of .001. Risk ratios were also calculated to indicate the practical significance between

groups. These values are represented in Table 2. As indicated in Table 2, arrestees who visited the ED were younger than ED users that were not arrested; and a higher proportion were male, black and Hispanic. The average number of ED contacts was significantly higher for the arrest group ( $M=7.6$ ,  $SD=12.6$ ) than for those without an arrest ( $M=2.7$ ,  $SD=4.5$ ). More arrestees also visited the ED multiple times, with nearly half (48%) making five or more ED contacts in a five-year period compared to 13% of non-arrestees. A significantly higher proportion of arrestees visited the ED to address the following health issues when compared to those without justice system involvement: abdominal pain; chronic physical health conditions; dental issues; general injuries; skull-related injuries; skin conditions; poisoning/overdose; STIs; wounds; mental illness overall (excluding substance abuse); anxiety; bipolar; depression; schizophrenia; suicide; and substance abuse.

In terms of multimorbidity, significantly more arrestees visited the ED to address three or more different chronic conditions; co-occurring mental health and substance abuse; chronic conditions in conjunction with substance abuse; co-occurring chronic physical health conditions, mental illness and substance abuse. Turning to repeat ED contacts for the same condition, significantly more arrestees than non-arrestees had multiple (3 or more) visits to the ED to address dental issues, skin conditions, injuries, mental illness (not drug or alcohol) and substance abuse.

Taking a step back, the characteristics on which these groups were compared were not necessarily selected because of an a priori expectation that arrestees would have significantly higher prevalence rates. The full data file contained hundreds of different diagnoses and, in the interest of being thorough, many were compared between the arrest

and no arrest groups with some comparisons omitted from this table. Except for only a handful of reasons for ED contact not listed in the table (e.g., chronic kidney disease, nutritional deficiencies), significantly more arrestees visited the ED for every health issue in the data. This included acute and chronic physical health conditions, serious mental illness, substance abuse, co-morbidity, even cancer and pregnancy/childbirth (also not listed here). Arrestees that accessed the ED were therefore found to have profoundly more health-related challenges than their non-arrested peers.

Lastly, it should be noted that Camden residents were compared to individuals from Camden County as a whole in tables included as Appendix K. In table A15 in particular, it is indicated what risk ratios differ significantly (more than 1 full RR) from those reported for the full sample when comparing arrestees to non-arrestees that visited the ED at least once between 2010 and 2014 (similar to Table 2 in Results section immediately below). In every case other than for being white, Camden residents reported a lower risk ratio (smaller difference) than for individuals from the full sample of Camden County residents. In other words, the practical difference between arrestees and non-arrestees from Camden City on reasons for ED contact were smaller than when comparing these groups for individuals in the County.

**Table 2.** Comparing ED Users who were Arrested, to those who were Not Arrested, between 2010 and 2014, on Demographics and Reasons for ED Contact

<u>Measure</u>	ED USE, NO ARREST (n=398,219)	ED USE & ARREST (n=16,723)	<i>sig</i>	Risk Ratio
Age (years)	45.2 (18.8)	32.9 (11.2)	< .001 ***	---
Gender (male)	45.5%	74.3%	< .001 ***	1.63
Race (black)	24.3%	49.3%	< .001 ***	2.03
Race (white)	62.5%	27.1%	< .001 ***	0.43
Ethnicity (Hispanic)	2.5%	23.2%	< .001 ***	9.28
Ever ED contact	100%	100%		
5 or + ED contacts	12.8%	48.4%	< .001 ***	3.78
ED contacts (#)	2.7 (4.5)	7.6 (12.6)	< .001 ***	
	<i>range: 1-464</i>	<i>range: 1-386</i>		
Abdominal pain	22.6%	26.2%	< .001 ***	1.16
Chronic condition	21.1%	25.0%	< .001 ***	1.18
3 or + chronic conditions	1.0%	1.9%	< .001 ***	1.90
3 or + ED (chronic cond.)	4.2%	8.4%	< .001 ***	2.00
Dental issues	3.8%	15.3%	< .001 ***	4.03
3 or + ED (dental issues)	0.8%	4.8%	< .001 ***	6.00
Injuries	37.5%	57.1%	< .001 ***	1.52
3 or + ED (injuries)	7.2%	21.4%	< .001 ***	2.97
Skull-related injuries	0.7%	4.0%	< .001 ***	5.71
Skin conditions	10.6%	30.2%	< .001 ***	2.85
3 or + ED (skin conditions)	1.4%	8.2%	< .001 ***	5.86
Poisoning/overdose	1.6%	7.9%	< .001 ***	4.94
3 or + ED (poisoning)	0.1%	0.8%	< .001 ***	8.00
STI	0.8%	8.7%	< .001 ***	10.88
Wounds	11.7%	27.6%	< .001 ***	2.36
Mental health (excluding SA)	9.5%	24.7%	< .001 ***	2.60
3 or + ED (MH excl. SA)	1.9%	8.0%	< .001 ***	4.21
Anxiety	4.1%	10.9%	< .001 ***	2.66
Bipolar	0.9%	2.7%	< .001 ***	3.00
Depression	2.4%	8.4%	< .001 ***	3.50
Schizophrenia	1.0%	3.5%	< .001 ***	3.50
Suicide	0.7%	4.7%	< .001 ***	6.71
Substance abuse	3.1%	26.4%	< .001 ***	8.52
3 or + ED (SA)	0.4%	7.7%	< .001 ***	19.25
Co-occurring MH & SA	1.3%	12.9%	< .001 ***	9.92
Chronic conditions + SA	0.8%	9.1%	< .001 ***	11.38
Chronic conditions + SA + MH	0.5%	5.6%	< .001 ***	11.20

\*\*\* p < .001 (Bonferroni correction .05/35 comparisons = .001)

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Percentages (%) represent proportion of group with ‘yes’ on a dichotomous measure. For continuous measures, group means and (standard deviations) are presented.

‘Sig.’ column represents statistically significant between-group differences (ANOVA, chi-square).

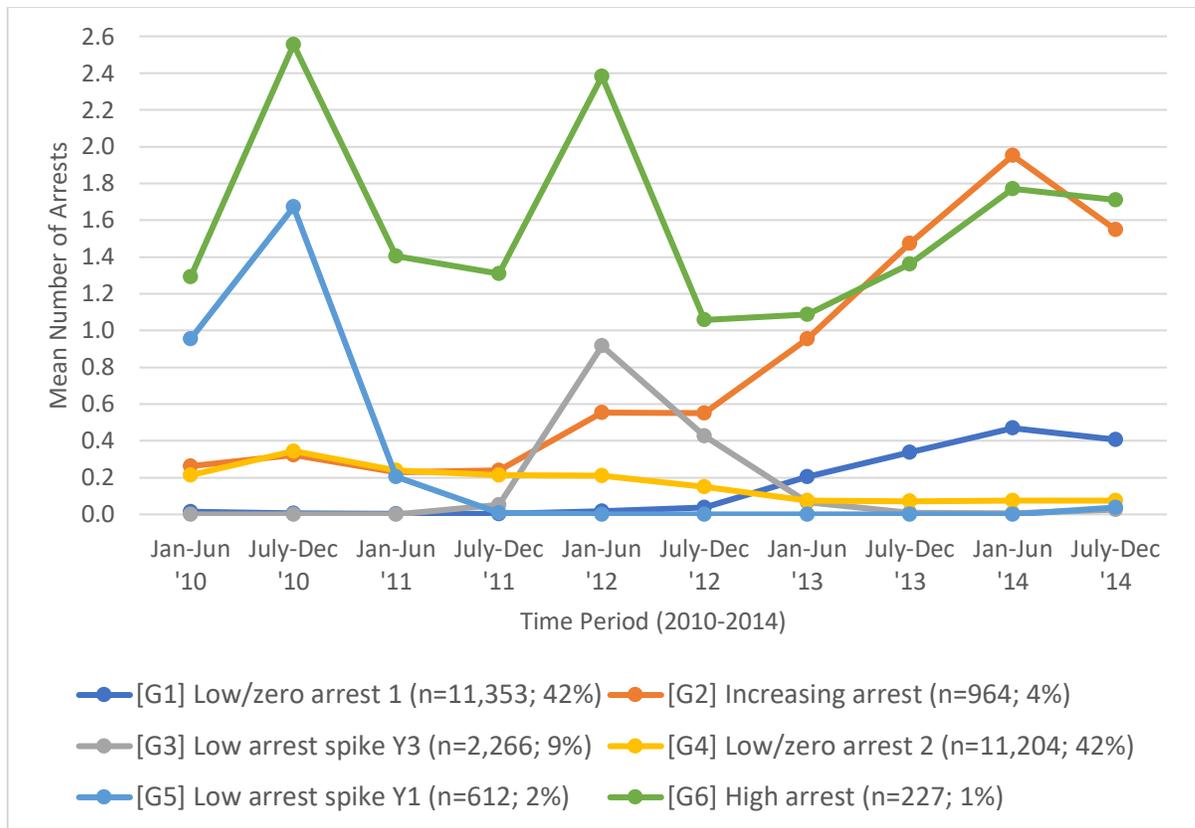
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### **[RQ2 & RQ3] Group-based Trajectory Modeling, Arrest and ED Contact**

Research questions 2 and 3 asked whether distinct trajectories through arrest and the ED (respectively) were present in the data. Analyses yielded a six-group solution for the arrest distribution and four groups for ED use. Described below are the specific steps taken and considerations made when choosing the final, best-fitting models. Trajectory groups within each model for the full sample will also be described. Again, the primary purpose of each individual trajectory model was to determine patterns of “frequent” single-system involvement in order to generate profiles of frequent cross-system involvement in a subsequent step. This purpose was behind many of the decisions made during the following analyses.

#### ***Model selection: Arrest, Full Sample***

The arrest trajectory models done in response to RQ2 were run on a sample of 26,626 individuals, or only those with at least one arrest between 2010 and 2014. The best-fitting group-based trajectory model for justice-involved adults was a six-group solution with four lower-order trajectories (few arrests) and two patterns of repeat/higher-order arrests (more frequent arrest). A plot of group means at each 6-month time point across the study period for the final 6-group solution is included as Figure 1.



**Figure 1.** Mean (Observed) Number of Arrests for each Arrest Trajectory per Six-Month Time Period, Full Adult Sample (N=26,626)

To arrive at a final solution, a series of models were run first specifying two through 14 groups, only stopping when the model would no longer converge. The BIC continued to improve (get smaller, less negative) with each additional group until the 11-group solution, after which (i.e., 12-group solution) the BIC value increased sharply. The 13- and 14-group models were not able to converge so were not considered; and no additional models were run past 14 groups.

For reasons discussed previously, the size of each trajectory group was of great importance when selecting a best-fitting model. Because of the minimum group-size criteria of 1%, arrest models containing 7 or more groups could be ruled out right away

(i.e., all included one or more groups < 1% of the trajectory sample). This left the 2-, 3-, 4-, 5- and 6-group models in consideration.

Next, a best-fitting final solution should include the fewest groups necessary to represent true group differences (i.e., rule of parsimony). The trajectory model with sufficient group size and the smallest (best) BIC would therefore be selected unless the addition of groups in that model from the prior does not add valuable information. In the case of arrest trajectories for the current (full) sample, the 6-group solution not only had the lowest BIC but also added explanatory value over and above the 5-group solution. Specifically, in the 6-group solution a high/chronic pattern emerges which is separate from the increasing (and previously highest) pattern seen with 5 groups. Given that the focus of this dissertation is on differentiation at the higher end of each distribution, this is meaningful new information. The BIC values for the 2- through 6-group models, rough trajectory descriptions and the size of the smallest trajectory group in each model are included as Table A1 in Appendix H.

Turning to additional model diagnostics, the 6-group solution was not perfect (as described below), but indicators of model fit were deemed adequate to proceed with this solution as the final model. Average posterior probabilities for each group in the 6-group solution are also included in Table A2 in Appendix H. Average posterior probabilities (AvePP) for groups ranged from 0.544 to 0.889 with two groups reporting values under the cut-off of 0.7 indicating “good” (Group 3 AvePP=0.544; Group 4 AvePP=0.664). Lastly, model diagnostics considered for the 6-group solution are included in Table A3 in Appendix H. The odds of correct classification (OCC) for each group ranged from 2.72 to 119.9 with values for Group 1 and Group 4 below the cut-off for “good” (i.e., 5).

The decision to use a final model with imperfect model diagnostics is justified for a number of reasons. First, the only model on the short list of those considered for the final solution with “perfect” diagnostics (i.e., AvePP > 0.7, OCC > 5) was the 3-group solution. According to BIC values, however, it is advantageous to continue adding groups to the model; and visually, adding groups past 3 paints an arguably much better and more nuanced picture of what arrest trajectories are represented in the data. In other words, choosing a solution with better group diagnostics would come at the cost of losing meaningful group differences and explanatory power that comes with the addition of trajectories. Second, group diagnostics are best (no issues) for the trajectories of most interest to this dissertation – repeat arrest, or the increasing and high trajectories – indicating these trajectories are the most stable.

### *Describing final arrest trajectories*

The 6-group solution includes most broadly four lower-order trajectories, one trajectory that increases from low to high, and one high and steady pattern of arrests. Because this dissertation is concerned with frequent system involvement, the increasing and high groups are the focus of most analyses and will be described in this paper in more detail than the four lower-order groups. These are the trajectories considered to represent two different patterns of “frequent” arrest.

Beginning with the lower-order trajectories, arrest group 1 [G1] is referred to as “Low/zero 1” (n=11,353). This group represents individuals who were not arrested at all in the first three years, then arrested very few times, likely once or twice, in the last two years of data collection. The group had a mean of 2.0 arrests in a five-year period (SD=1.6). More than 60% of this group visited the ED at least once, with a group mean

of 4.4 ED visits (SD=9.3). Like all four lower-order trajectories, this group basically mirrors the general arrest sample in terms of demographics, percent arrested for different offense types and percent ever visited the ED for a range of health-related reasons.

Arrest group 3 [G3] or “Low, spike Y3” represents individuals who were not arrested at all, or very rarely, in years 1, 2, 4 and 5 with a small spike in arrests (likely 1 or 2) during year 3 (n=2,266). This group had a mean of 1.9 arrests over five years (SD=1.8). Roughly half (54.5%) of this trajectory visited the ED at least once, with a group mean of 3.9 ED visits between 2010 and 2014 (SD=8.4). This group had the youngest mean age (24.7 years; SD=6.8) across arrest trajectories; but otherwise closely mirrored the total arrest sample.

Arrest group 4 [G4], referred to as “Low/zero 2”, shows a pattern of nearly zero arrests over the five-year period with slightly more arrests, as a group, during the first three years of data collection (n=11,204). Members of this group were likely arrested just once or twice during the first half of the study period, with a mean of 2.1 arrests over five years (SD=1.8). Sixty-two percent of this trajectory visited the ED at least once with a mean of 4.7 visits (SD=6.8).

Arrest group 5 [G5] (“Low, spike Y1”; n=612) represents individuals who were not arrested at all, or arrested very rarely, during most years of data collection other than year one, during which time they were arrested once or twice. The group mean number of arrests is 3.6 – slightly higher than for the other lower-order groups, but not significantly so (SD=2.2). Nearly three-quarters (74%) of this group visited the ED, with a group mean of 4.7 visits over five years (SD=6.8).

Turning to the highest-rate trajectories, group 2 [G2] or “Increasing arrest” (n=964), represents individuals who started the study period with slightly above zero arrests and ended it on par with the high group. This group had 10.8 average arrests over five years (SD=4.6) with a range from 5 to 47. Nearly all (92.4%) of this group visited the ED at least once, with a mean of 10.5 ED visits over the five-year period (SD=19.4).

Group 6 [G6], or “High arrest” (n=227) encompasses individuals with the most arrests, consistently over the five-year study period. The group mean is nearly 20 arrests (19.8) in five years with a range from 8 to 124 (SD=12.6). Again, nearly all (96.0%) of this trajectory visited the ED at least once with a group mean of 18.1 ED visits over five years (SD=33.3). Table 3 displays characteristics associated with each arrest trajectory group, as well as for the full arrest sample for comparison.

### ***Factors that differentiate between arrest groups***

Because the ultimate intent of this dissertation is to understand factors associated with frequent entry into the criminal justice system, I will focus here on what differentiates higher-end trajectories from each other, and from those representing less frequent arrest. Each of the two highest-order arrest trajectories (‘increasing’ and ‘high’) were compared to the lowest arrest trajectory (‘low/zero arrest 1’) on a range of characteristics using chi-square and ANOVA for individual comparisons. A column in Table 3 indicates what pairwise comparisons were statistically significant for high arrest versus low arrest (column title ‘G6 vs. G1’); one column indicates significance for the increasing arrest group versus low arrest (column title ‘G2 vs. G1’); and the last column in the table indicates significant differences for high arrest versus increasing arrest (column title ‘G6 vs. G2’).

Descriptive analyses reveal that a range of demographic, health-related and offending characteristics differentiate between the highest and lowest arrest trajectories. The difference between high arrest (group 6) and low arrest (group 1) is statistically significant for all factors considered in Table 3 with the exceptions of any ED contact for abdominal pain, STIs, bipolar disorder, age and being black. Similarly, every between-group difference for group 2 (increasing arrest) versus group 1 (low arrest) was statistically significant except for age and any ED contact for a chronic condition, for multiple (3 or more) chronic conditions, multiple dental and skin conditions, bipolar disorder, age and race/ethnicity. Group 6 (high arrest) and group 2 (increasing arrest) were distinct on most factors considered in Table 3, thus making the argument that these are distinct groups that demonstrate different patterns of repeat or frequent arrest over five years and different clusters of need across domains.

If we take low/zero (1) arrest, increasing arrest, and high as 3 “levels” of arrest, certain important characteristics increase in a linear fashion along with the number or “level” of arrests. These values are all listed in Table 3 below. While most (but not all) variables follow this pattern, here I pulled out more interesting findings and/or the biggest jumps in value across groups. For one, 61% of the low/zero arrest group visited the ED at least once, compared to 92.4% of increasing arrest and 96% of high. Mean number of ED visits over five years also followed this pattern (7.1 for low, 11.4 for increasing, 18.9 for high). Descriptively, this tells us that ED contact increases in prevalence and frequency as number of arrests goes up.

Similarly, any ED contact for skull-related injuries, depression, substance abuse, mental illness, and all indicators of comorbidity increased sharply with each “level” of

arrest. Looking again at prostitution, only 1% of the low/zero arrest group had an arrest for this offense, compared to 3.4% of increasing and 26.9% of high. Split by gender, this comprises 79.1% of the women in the high arrest group. Again, while descriptive, this tells us a great deal about what important issues seem to accumulate along with an increase in arrests.

**Table 3. Demographic, Health- and Justice-Related Characteristics for each Arrest Trajectory, Full Sample (n=26,626)**

Measure	TOTAL ARREST SAMPLE (N=26,626)	Arrest Trajectory Groups						G6 vs. G1	G2 vs. G1	G6 vs. G2
		Arrest [G1] low/zero arrest (1) (n=11,353)	Arrest [G2] increasing arrest (n=964)	Arrest [G3] low arrest spike @ Y3 (n=2,266)	Arrest [G4] low/zero arrest (2) (n=11,204)	Arrest [G5] low arrest spike @ Y1 (n=612)	Arrest [G6] high arrest (n=227)			
Age (years)	33.1 (11.3)	32.7 (11.2)	29.7 (9.7)	24.7 (6.8)	35.6 (11.5)	32.6 (10.0)	35.2 (10.7)	.776	.071	***
18-21 years old	17.3%	18.9%	24.3%	41.3%	10.7%	10.6%	9.7%	***	***	***
50-65 years old	9.5%	8.6%	5.0%	1.5%	12.5%	7.4%	9.7%	.561	***	.007
Gender (male)	76.9%	76.8%	85.0%	73.6%	77.2%	76.0%	70.5%	.025	***	***
Race (black)	44.9%	44.0%	51.9%	34.4%	47.6%	37.9%	48.5%	.184	***	.355
Race (white)	30.9%	30.6%	27.0%	41.4%	28.3%	46.7%	37.9%	.019	.017	***
Ethnicity (Hispanic)	23.7%	24.7%	21.0%	23.7%	23.5%	14.9%	13.7%	***	.009	.013
Camden resident	64.2%	62.0%	85.2%	53.3%	66.2%	63.9%	94.7%	***	***	***
Ever ED contact	62.8%	61.1%	92.4%	54.5%	62.4%	74.0%	96.0%	***	***	.053
5 or + ED contacts	30.4%	28.2%	59.3%	25.5%	30.0%	33.2%	73.1%	***	***	***
ED contacts (#)	4.8 (10.6)	4.3 (9.3)	10.5 (19.4)	3.9 (8.4)	4.7 (10.1)	4.7 (6.8)	18.1 (33.3)	***	***	***
<i>range</i>	0-386	0-386	0-320	0-176	0-299	0-64	0-338			
Arrests (#)	2.5 (3.2)	2.0 (1.6)	10.8 (4.6)	1.9 (1.8)	2.1 (1.8)	3.6 (2.2)	19.8 (12.6)	***	***	***
<i>range</i>	1-124	1-20	5-47	1-19	1-18	2-17	8-124			
Disorderly arrest	41.2%	41.7%	80.6%	51.7%	34.1%	40.5%	94.3%	***	***	***
Disorderly arrests (#)	0.6 (1.4)	0.5 (0.7)	2.5 (2.7)	0.6 (0.9)	0.4 (0.7)	0.6 (0.9)	6.5 (8.9)	***	***	***
Drug arrest	31.9%	29.8%	76.4%	27.2%	29.4%	48.9%	80.2%	***	***	.217
Drug arrests (#)	0.6 (1.2)	0.5 (1.0)	2.7 (2.8)	0.5 (1.1)	0.5 (1.0)	0.9 (1.1)	3.4 (3.3)	***	***	.131
Property arrest	7.1%	4.7%	21.6%	7.0%	7.8%	8.7%	32.2%	***	***	***
Prostitution arrest	1.7%	1.0%	3.4%	0.5%	1.9%	3.6%	26.9%	***	***	***
Violent crime arrest	11.2%	9.2%	20.2%	11.6%	12.3%	9.5%	20.7%	***	***	.872

3 or + arrests (violent)	0.4%	0.2%	2.4%	0.3%	0.4%	1.0%	1.8%	***	***	.570
Weapons arrest	3.76%	2.9%	9.9%	3.8%	4.0%	5.1%	6.6%	***	***	.128

***BELOW – only individuals in each group that visited the ED at least once***

	(n=16,723)	(n=6,932)	(n=891)	(n=1,235)	(n=6,994)	(n=453)	(n=218)			
ED contacts (#)	7.6 (12.6)	7.1 (11.1)	11.4 (19.9)	7.1 (10.3)	7.5 (11.9)	6.3 (7.3)	18.9 (33.8)	***	***	***
Abdominal pain	26.2%	26.7%	23.3%	29.4%	25.6%	22.5%	30.3%	.241	.032	.033
Chronic condition	25.0%	23.5%	23.8%	20.2%	27.4%	21.9%	34.9%	***	.853	***
3 or + chronic conditions	1.9%	1.5%	1.9%	1.0%	2.4%	1.6%	5.1%	***	.372	.008
3 or + ED (chronic cond.)	8.4%	7.9%	8.2%	5.6%	9.5%	5.3%	14.7%	***	.742	.003
Dental	15.3%	15.3%	19.1%	15.1%	14.5%	15.2%	22.5%	.004	.004	.259
3 or + ED (dental)	4.8%	4.9%	6.6%	5.8%	4.1%	5.1%	10.1%	***	.028	.078
Injuries	57.1%	56.0%	66.3%	55.5%	57.3%	51.2%	69.7%	***	***	.339
3 or + ED (injuries)	21.4%	20.3%	28.1%	21.1%	21.7%	16.8%	34.4%	***	***	.065
Injuries (#)	1.6 (2.7)	1.5 (2.4)	2.3 (3.7)	1.6 (2.5)	1.6 (2.7)	1.3 (2.0)	2.8 (4.5)	***	***	.229
Skull-related injuries	4.0%	3.6%	7.0%	4.1%	3.7%	4.4%	15.6%	***	***	***
Skin conditions	30.2%	28.2%	43.4%	26.3%	30.2%	34.0%	56.0%	***	***	***
3 or + ED (skin)	8.2%	7.1%	14.4%	7.0%	8.3%	8.2%	21.6%	***	***	.009
Poisoning/overdose	7.9%	6.9%	16.1%	7.7%	7.5%	9.5%	20.2%	***	***	.144
3 or + ED (poisoning)	0.8%	0.7%	1.4%	0.6%	0.7%	1.6%	6.4%	***	.025	***
STI	8.7%	8.4%	14.7%	9.6%	8.3%	7.7%	8.7%	.855	***	.021
Wounds	27.6%	25.0%	43.2%	29.0%	27.2%	28.3%	46.8%	***	***	.340
Mental health (excluding SA)	24.7%	23.5%	31.2%	22.4%	24.9%	26.1%	39.5%	***	***	.020
3 or + ED (MH excl. SA)	8.0%	7.3%	11.5%	7.5%	8.0%	8.2%	23.9%	***	***	***
Mental health excl. SA (#)	0.9 (4.8)	0.8 (4.9)	1.4 (5.2)	0.7 (2.1)	0.2 (4.7)	0.7 (2.1)	2.5 (11.6)	***	***	.006
Anxiety	10.9%	10.6%	14.5%	10.3%	10.6%	11.3%	21.1%	***	***	.016
Bipolar	2.7%	2.5%	3.0%	2.2%	2.9%	2.9%	5.1%	.021	.370	.143
Depression	8.4%	7.5%	12.7%	7.4%	8.5%	9.7%	21.6%	***	***	***
Schizophrenia	3.5%	3.1%	5.5%	2.4%	3.5%	4.2%	9.2%	***	***	.044
Suicide	4.7%	4.4%	8.3%	4.3%	4.3%	5.5%	13.3%	***	***	.023

Substance abuse	26.4%	24.1%	42.5%	23.5%	25.5%	31.8%	64.2%	***	***	***
3 or + ED (SA)	7.7%	6.2%	19.5%	5.9%	7.0%	8.0%	40.4%	***	***	***
Substance abuse (#)	0.8 (3.4)	0.6 (2.6)	1.7 (4.1)	0.6 (3.0)	0.7 (2.4)	0.7 (1.4)	4.6 (18.7)	***	***	***
Co-occurring MH & SA	12.9%	11.6%	23.1%	11.2%	12.3%	14.6%	36.2%	***	***	***
Chronic conditions + SA	9.1%	7.7%	15.9%	6.7%	9.4%	8.8%	26.6%	***	***	***
Chronic conditions + SA + MH	5.6%	4.7%	10.8%	4.3%	5.8%	5.7%	17.9%	***	***	.004

\*\*\*  $p < .001$  (Bonferroni correction  $.05/51$  comparisons =  $.001$ )

Controlled for age in final trajectory models for the full adult sample.

Percentages (%) represent proportion of group with 'yes' on a dichotomous measure. For continuous measures, group means and (standard deviations) are presented.

'G6 vs. G1', 'G2 vs. G1', 'G6 vs. G2' columns represent statistically significant between-group differences (ANOVA, chi-square).

The greyed-out column labeled TOTAL ARREST SAMPLE is included for comparison.

Looking further into differences between the high and increasing arrest groups, a logistic regression model was run to predict membership in the high arrest group over increasing arrest using first age, then age plus a number of relevant factors on which the high and increasing arrest groups differed significantly. Results are included as Table 7. The purpose of this step was to determine whether the increasing arrest trajectory [G2] represents younger but similarly unhealthy individuals when compared to the high arrest trajectory [G6]. In other words, are members of the increasing arrest group just younger counterparts of those in the high arrest group? Will many individuals in the increasing arrest group transition into a high trajectory over time (i.e., with increased age) if their needs are left unaddressed?

Results displayed in Table 4 indicate that as individuals get older, they experience significantly higher odds of membership in the high arrest trajectory over the increasing arrest group. Specifically, with each additional year of age individuals in this sample are 5% more likely to belong to the high arrest trajectory [G6] over the increasing arrest group [G2]. This relationship remains significant even after controlling (in the subsequent model) for other relevant predictors like multiple chronic conditions, mental illness, substance abuse and co-morbidity. Any arrest for prostitution also independently increased one's odds of membership in the high arrest trajectory by 807%. No other predictors in the final model were significant – other than number of arrests, which was included as a control since individuals in G6 (high) had, on average, more arrests than members of G2 (increasing).

**Table 4.** *Logistic Regression Models Predicting Membership in High Arrest Trajectory [G6] (n=227)*

Predictor	Model 1	Model 2
Age (years)	1.05 (1.04-1.07) ***	1.06 (1.03-1.08) ***
Gender (male)	---	1.24 (0.69-2.24)
Race (black)	---	0.74 (0.47-1.18)
Ethnicity (Hispanic)	---	0.60 (0.34-1.06)
Arrests (#)	---	1.22 (1.18-1.27) ***
Prostitution (any arrest)	---	9.07 (4.55-18.07) ***
Disorderly (# of arrests)	---	0.94 (0.88-1.01)
Chronic conditions (3 or +)	---	1.38 (0.52-3.66)
Depression (any ED)	---	0.97 (0.52-1.79)
Anxiety (any ED)	---	0.97 (0.53-1.78)
Substance abuse (any ED)	---	1.21 (0.75-1.96)
Co-occurring MH & SA (ever)	---	1.47 (0.77-2.79)
constant	0.05 (0.03-0.08) ***	0.002 (0.001-0.005) ***
<i>Model x2 (df)</i>	50.27 (1)	396.76 (12)
<i>Pseudo R2</i>	0.04	0.32
<i>N</i>	1,191	1,191

\*\*\* p < .001; \*\* p < .01; \* p < .05

Data are given as odds ratio (95% confidence interval).

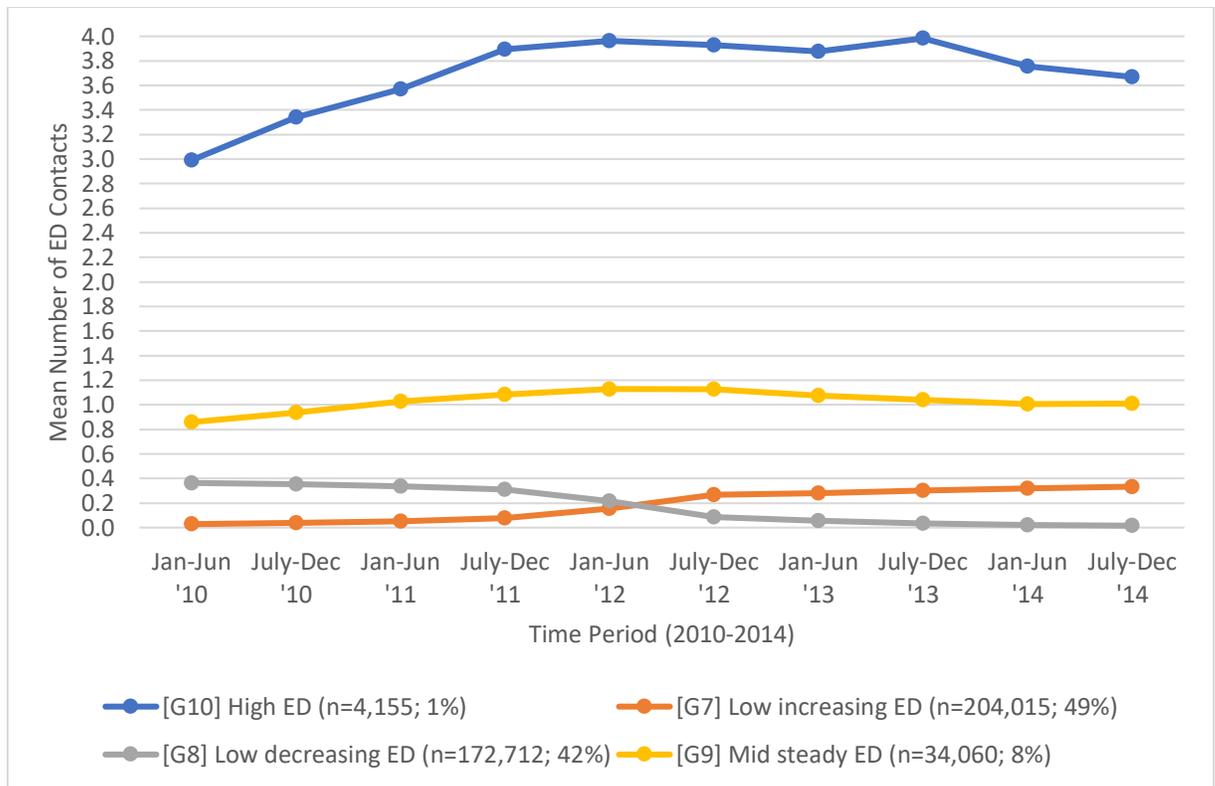
Reference group is Increasing arrest trajectory [G2] (n=964).

***Model selection: ED Visits, Full Sample***

First, using a count of ED visits per 6-month bin as the trajectory variables generated an error in STATA. That is, the model would not converge, and no information was returned for the model. I consulted Bobby Jones, a Research Scientist at Carnegie Mellon University who worked with Daniel Nagin to develop group-based trajectory modeling. The pair have published a number of articles on this methodology (e.g., Jones & Nagin, 2007; Jones et al., 2001; Jones & Nagin, 2013). Through email conversations, we decided the errors were likely the result of outliers in one or more bins (B. Jones, personal communication, February 15, 2019). To address this, values in each bin of ED data were capped at 20 visits. Capping each bin at 20 ED visits was the smallest change that could be made to improve the model. This only impacted the 22 people who had a

value in at least one ED bin in excess of 20, or a 5-year total of more than 200 ED visits. Doing this allowed for subsequent group-based trajectory models to function as normal. This strategy was chosen over a transformation of the ED variables (i.e., Dr. Jones' other suggestion) because of the plan to bring arrest and ED use trajectories together, thus making it important that each outcome was interpretable on the same scale. Data transformations can also yield trajectories that are not as visually useful; and the visual presentation of trajectories are important descriptive tools especially for explaining results to provider during qualitative interviews. I wanted to add as little complexity to any model as possible.

Group-based trajectory modeling for ED contacts utilized a sample of 414,942 individuals, or anyone in the data with at least one ED visit between 2010 and 2014. The best-fitting group-based trajectory model for ED use was a 4-group solution with two lower-order trajectories, one mid/steady trajectory, and one pattern of repeat/higher-order ED contact. A plot of the final 4-group solution is included as Figure 2.



**Figure 2.** Mean (Observed) Number of ED Contacts for each ED Trajectory per Six-Month Time Period, Full Adult Sample (N=414,942)

Again, a series of models were run beginning with 2 ED groups. The BIC continued to improve through 7 groups. The individual group size criteria of at least 1% could not be satisfied, however, beginning with the 5-group solution. This left the 4-group model as the solution with the lowest/best BIC among models with adequate individual group sizes. In addition to a better BIC value, four groups were chosen over the 3-group solution because a mid/steady pattern emerged in the 4-group solution not present in prior models with fewer groups. This additional group, comprised of 34,060 (8.2%) individuals, was considered a meaningful contribution. The BIC values for the 2-through 5-group models, rough trajectory descriptions and the size of the smallest trajectory group in each model are included as Table A4 in Appendix H.

Turning to group and model diagnostics, the 4-group solution was a satisfactory fit to the data. Average posterior probabilities for each group in the 4-group solution are included in Table A5, all of which were in the range of “good” or better (greater than 0.7). All additional model diagnostics considered for the final 4-group solution including but not limited to AvePP are listed in Table A6 in Appendix H. The OCC for ED G7 was 3.71 and 4.26 for G8 – both of which are shy of the cut-off of 5 for “good”. Lower OCC values for the two lowest-order groups could mean that the model had some trouble determining group membership for individuals at the bottom of the distribution just above zero as the two lowest-order groups demonstrated a similar pattern. Otherwise, all diagnostics were in an acceptable range.

### ***Describing final ED groups***

The 4-group solution includes two lower-order ED trajectories [G7, G8], one trajectory of consistent mid-level ED use [G9], and a high ED [G10] trajectory. Table 5 displays characteristics associated with each ED use trajectory group. The ‘Low increasing ED’ [G7] (n=204,015) and ‘Low decreasing ED’ [G8] (n=172,712) trajectories represent 90.7% of individuals in the total ED sample. Members of the ‘Low increasing ED’ [G7] group visited the ED one or two times during the last half of the five-year study period. Inversely, members of the ‘low decreasing ED’ [G8] group visited the ED one or two times during the first half of the five-year period. These groups were significantly different from each other in terms of the demographic, health- and justice-related factors examined here.

The ‘mid steady ED’ trajectory [G9] (n=34,060) represents individuals who visited the ED an average of 10 times in a five-year period (SD=3.8); and 15.2% of this

group were arrested at least once during the same five-year period. The highest ED trajectory, 'high ED' [G10] (n=4,155), visited the ED an average of 37 times (SD=26.8) between 2010 and 2014; and 24.7% were arrested at least once.

### ***Factors that differentiate between ED groups***

Similar to the methods undertaken with the arrest trajectories, chi-square and ANOVA were used to make comparisons between ED trajectories, with results included as two separate columns in Table 5. First, the column entitled 'G8 vs. G10' includes results of the comparison between the low decreasing and the high ED group. The high ED trajectory was also compared to mid steady ED trajectory, with results indicated in the column titled 'G9 vs. G10'. Again, a Bonferroni correction was applied so all p-values were set to .001.

Members of the high ED group [G10] differ significantly from both the low ED [G8] and mid ED [G9] groups on most factors included in the table. People that visit the ED more often therefore did so to address many different health challenges from acute to chronic, physical to behavioral. To highlight an important finding, ED contact for co-morbid issues was much more prevalent among individuals who visit the ED more often. Demographically, members of the high ED group are significantly younger than those in the low ED and mid ED groups. A higher proportion are also female, black and Hispanic.

Turning to arrest, considering only individuals in each group that were arrested at least once, significantly more members of the high ED trajectory than in either low ED or mid ED groups were arrested for disorderly crimes. Comparing only high ED to low ED, more members of the high ED trajectory were also arrested for drug crimes, property crimes, violent offenses and prostitution.

Like with arrest, one could perceive the following groups as three increasing “levels” of ED use: low decreasing [G8], mid steady [G9], high [G10]. Using this convention, the proportion of each group that was ever arrested increased in a linear fashion with 2.5% of the low ED group ever arrested compared to 15.2% of mid steady and 24.7% of high. This was also the case for the proportion of each group that was arrested five or more times (0.4% vs. 6% vs. 19.8%). Other factors that jumped considerably with each “level” of ED use included ED contact for injuries, and multiple contacts for injuries, which implies that repeat ED use is not always explained by excess visits for non-acute conditions as injuries are a very justifiable reason to visit the ED. Indicators of mental illness, substance abuse and comorbidity also increased with each level of ED contact.

**Table 5. Demographic, Health- and Justice-Related Characteristics for each ED Trajectory, Full Sample (N=414,942)**

Measure	TOTAL ED SAMPLE (N=414,942)	ED Trajectory Groups				G8 vs. G10	G9 vs. G10
		ED [G7]	ED [G8]	ED [G9]	ED [G10]		
		low increasing ED (n=204,015)	low decreasing ED (n=172,712)	mid steady ED (n=34,060)	high ED (n=4,155)		
Age (years) ^	44.7 (18.7)	44.2 (18.7)	47.0 (19.0)	38.0 (15.8)	36.4 (13.6)	***	.008
18-21 years old	9.5%	10.5%	7.4%	13.8%	13.2%	***	.299
50-65 years old	20.4%	19.9%	22.3%	14.3%	13.9%	***	.443
Gender (male)	46.6%	47.4%	48.0%	37.0%	32.9%	***	***
Race (black)	24.3%	22.6%	22.4%	41.8%	47.2%	***	***
Race (white)	61.1%	62.8%	64.4%	37.0%	34.7%	***	.004
Ethnicity (Hispanic)	3.4%	3.0%	2.9%	7.5%	8.4%	***	.051
Ever ED contact	100%	100%	100%	100%	100%		
5 or + ED contacts	14.2%	5.8%	5.2%	100%	100%	***	
ED contacts (#)	2.9 (5.2)	1.8 (1.3)	1.8 (1.2)	10.3 (3.8)	37.0 (26.8)	***	***
	<i>range</i>	<i>1-464</i>	<i>1-8</i>	<i>1-11</i>	<i>5-27</i>		
Ever Arrest	4.0%	3.0%	2.5%	15.2%	24.7%	***	***
5 or + Arrests	0.8%	0.5%	0.4%	3.5%	7.0%	***	***
Abdominal pain	22.8%	18.8%	19.5%	56.2%	81.6%	***	***
Chronic condition	21.3%	18.3%	18.3%	48.4%	71.9%	***	***
3 or + chronic conditions	1.0%	0.4%	0.4%	6.0%	18.8%	***	***
3 or + ED (chronic cond.)	4.4%	2.2%	2.1%	23.5%	49.1%	***	***
Dental	4.3%	2.8%	2.5%	18.1%	38.3%	***	***
3 or + ED (dental)	1.0%	0.3%	0.3%	6.0%	19.8%	***	***
Injuries	38.3%	34.0%	35.6%	71.8%	90.7%	***	***
3 or + ED (injuries)	7.8%	4.7%	4.9%	33.3%	69.5%	***	***

Injuries (#)	0.8 (1.5)	0.6 (1.0)	0.6 (1.0)	2.1 (2.3)	6.1 (7.0)	***	***
Skull-related injuries	0.9%	0.7%	0.7%	2.3%	6.1%	***	***
Skin conditions	11.4%	8.7%	8.2%	37.7%	60.8%	***	***
3 or + ED (skin)	1.6%	0.6%	0.6%	10.1%	28.7%	***	***
Poisoning/overdose	1.8%	1.4%	1.2%	6.0%	14.8%	***	***
3 or + ED (poisoning)	0.1%	0.0%	0.0%	0.5%	2.3%	***	***
STI	1.1%	0.6%	0.6%	5.7%	11.0%	***	***
Wounds	12.3%	10.6%	11.4%	24.5%	39.3%	***	***
Mental health (excluding SA)	10.1%	7.7%	7.0%	32.9%	65.6%	***	***
3 or + ED (MH excl. SA)	2.1%	0.9%	0.9%	10.8%	39.5%	***	***
Mental health excl. SA (#)	0.2 (1.9)	0.1 (0.5)	0.1 (0.5)	0.9 (2.1)	5.2 (16.1)	***	***
Anxiety	4.4%	3.2%	2.7%	15.9%	40.8%	***	***
Bipolar	1.0%	0.6%	0.5%	4.3%	14.0%	***	***
Depression	2.7%	1.7%	1.8%	9.9%	28.0%	***	***
Schizophrenia	1.1%	0.6%	0.8%	3.7%	12.0%	***	***
Suicide	0.8%	0.5%	0.4%	3.3%	12.0%	***	***
Substance abuse	4.0%	2.9%	2.7%	13.6%	30.5%	***	***
3 or + ED (SA)	0.7%	0.2%	0.2%	4.1%	15.1%	***	***
Substance abuse (#)	0.1 (1.1)	0.0 (0.3)	0.0 (0.3)	0.3 (1.2)	2.2 (9.8)	***	***
Co-occurring MH & SA	1.8%	1.0%	0.9%	8.3%	26.3%	***	***
Chronic conditions + SA	1.1%	0.4%	0.5%	6.1%	22.6%	***	***
Chronic conditions + SA + MH	0.7%	0.2%	0.2%	3.8%	19.8%	***	***

***BELOW - only individuals in each group that were arrested at least once***

	(n=16,723)	(n=6,128)	(n=4,379)	(n=5,191)	(n=1,025)		
Arrests (#)	3.1 (3.8)	2.8 (3.2)	2.6 (2.8)	3.5 (4.2)	4.4 (6.9)	***	***
	<i>range</i>						
	<i>1-124</i>	<i>1-47</i>	<i>1-64</i>	<i>1-59</i>	<i>1-124</i>		
Disorderly arrest	39.8%	39.5%	34.6%	42.3%	51.3%	***	***
Disorderly arrests (#)	0.7 (1.6)	0.6 (1.2)	0.5 (1.0)	0.8 (1.6)	1.4 (4.2)	***	***
Drug arrest	35.2%	37.8%	34.9%	33.2%	30.6%	.010	.106

Drug arrests (#)	0.7 (1.4)	0.8 (1.4)	0.6 (1.2)	0.7 (1.5)	0.7 (1.5)	***	.466
Property arrest	8.9%	7.2%	7.6%	11.0%	14.3%	***	.002
Prostitution arrest	1.6%	1.3%	1.4%	2.0%	2.8%	***	.114
Violent crime arrest	14.3%	11.4%	11.9%	18.3%	21.4%	***	.022
3 or + arrests (violent)	0.6%	0.4%	0.4%	0.8%	1.0%	.023	.502
Weapons arrest	4.7%	4.3%	5.0%	5.0%	3.8%	.100	.105

\*\*\*  $p < .001$  (Bonferroni correction  $.05/51$  comparisons =  $.001$ )

Controlled for age in final trajectory models for the full adult sample.

Percentages (%) represent proportion of group with 'yes' on a dichotomous measure. For continuous measures, group means and (standard deviations) are presented.

'G8 vs. G10', 'G9 vs. G10' columns represent significant between-group differences (ANOVA, chi-square).

The greyed-out column labeled TOTAL ED SAMPLE is included for comparison.

In sum, the above findings show distinct groups did emerge, two of which were patterns of “frequent” ED contact (out of four groups). Individuals who visited the ED more often tended to be younger, which is interesting given their high rate of system involvement. High-rate ED users also presented with worse health (which makes sense) as well as more arrests – demonstrating another link between higher levels of contact with the ED and more frequent arrest.

#### **[RQ4] Relationship between Arrest and ED Trajectories**

Research question 4 asks about the relationship between arrest and ED use trajectory group membership during the same period of time. A cross-classification analysis was done to answer this question, which will be described in detail below. The purpose of this step was to determine whether members of frequent trajectories were more likely to frequently contact the other system during the same period of time.

First as an overview, Table 6 includes the number of individuals in each of the 24 joint trajectory groups. To be clear, in this step I crossed membership in arrest trajectories with those for ED use to assign each cross-system involved individual in the sample a “joint trajectory group” (e.g., increasing arrest/mid steady ED, low/zero arrest 1/high ED). These analyses therefore only included adults in the sample that visited the ED at least once, and were arrested at least once, between 2010 and 2014 (N=16,723). The column labeled ‘ED USE & ARREST’ in Table 2 (used to answer RQ1 above) includes basic descriptive information for the cross-system involved sample. The 16,723 individuals described in Table 2 are the same people who were assigned to a joint trajectory group here.

**Table 6. Basic Cross-Tabulation of Arrest and ED Joint Trajectory Groups**

Arrest Trajectories	No ED	ED Trajectories			
		low increasing ED [G7] (n=204,015)	low decreasing ED [G8] (n=172,712)	mid steady ED [G9] (n=34,060)	high ED [G10] (n=4,155)
No arrests	n/a	197,887	168,333	28,869	3,130
low/zero arrest (1) [G1] (n=11,353)	4,421	3,158 (18.9%)	1,328 (7.9%)	2,070 (12.4%)	376 (2.3%)
increasing arrest [G2] (n=964)	73	328 (2.0%)	103 (0.6%)	356 (2.1%)	104 (0.6%)
low arrest, spike @ Y3 [G3] (n=2,266)	1,031	451 (2.7%)	336 (2.0%)	381 (2.3%)	67 (0.4%)
low/zero arrest (2) [G4] (n=11,204)	4,210	2,076 (12.4%)	2,350 (14.1%)	2,152 (12.9%)	416 (2.5%)
low arrest, spike @ Y1 [G5] (n=612)	159	80 (0.5%)	232 (1.4%)	125 (0.8%)	16 (0.1%)
high arrest [G6] (n=227)	9	35 (0.2%)	30 (0.2%)	107 (0.6%)	46 (0.3%)

Data are given as the n and percent of total cross-system involved population (N=16,723) in each joint trajectory group.

The greyed-out column and row display the number of people in each trajectory that were not involved with the opposite system. Because of the nature of the data (everyone is system-involved), there were no individuals with 0 arrests and 0 ED visits – thus the n/a in that cell.

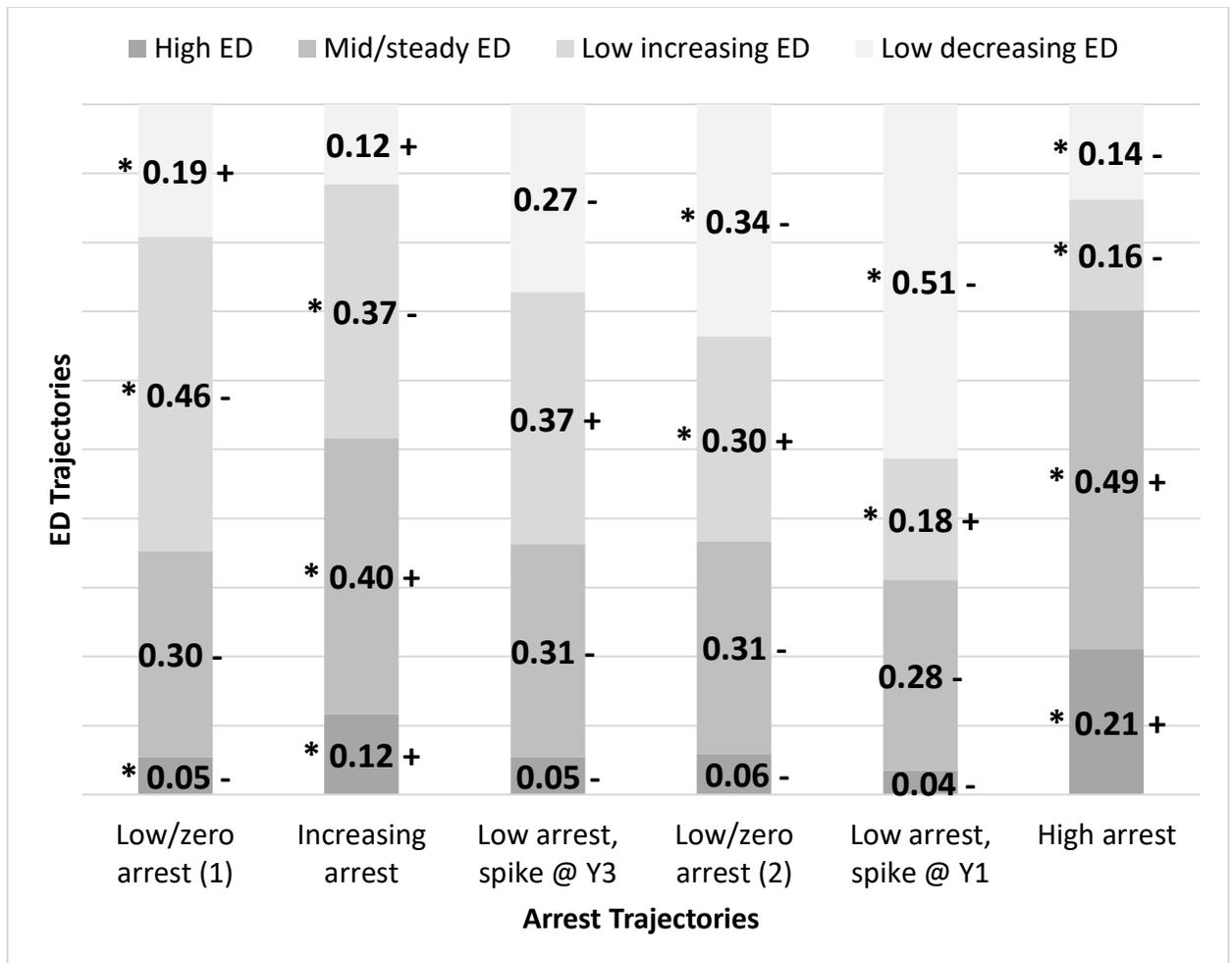
### ***Cross-Classification Analysis – Full Sample***

Conditional probabilities were generated and graphed, or the probabilities of membership in a given arrest trajectory conditional on membership in a given ED use trajectory. The overall cross-classification model was significant ( $\chi^2(15, N=16,723)971.71, p<0.001$ ). In response to the second hypothesis (H2), results indicate that significantly more individuals in a “frequent” arrest trajectory (‘increasing’ and ‘high’ arrest) were also members of the “frequent” ED use trajectory (‘high’) than would have been expected by chance.

Figure 3 displays conditional probabilities for each pairing (arrest by ED group). The + and – symbols indicate whether a count was more (+) or less (-) than would be

expected by chance. Additionally, in the figure it is indicated with an asterisk when the difference between an observed and expected frequency reached statistical significance as indicated by a Pearson residual larger than 2 or less than -2.

Descriptively, 21.1% of members of the high arrest trajectory were also members of the high ED group; and 49.1% were in the mid ED trajectory. Among members of the increasing arrest group, 11.7% were in the high ED group and 40% in mid ED. Again, these values were all more than would have been expected by chance. This tells us that a majority, or more than 70% of people in the high arrest trajectory, made repeat visits to the ED consistently over the same period of time in which they were being frequently arrested. Similarly, more than half (51.7%) of the increasing arrest group made frequent contact with the ED while also demonstrating a pattern of frequent, increasing arrests.



\* indicates a difference that is statistically significant (Pearson residual > 2 or < -2)  
 +/- indicates whether frequency was more (+) or less (-) than was expected by chance

**Figure 3.** Probability of Membership in a Given Arrest Trajectory Conditional on Membership in a Given ED Use Trajectory

We can also learn a great deal about the relationship between frequent arrest and frequent ED use by reviewing descriptive statistics reported in previous tables. First, displayed in Table 3, 62.8% of the total arrest sample visited the ED at least once. This closely mirrors the proportion of each low/zero arrest trajectory that made any contact with the ED (61.1% and 62.4%). For the increasing arrest and high arrest trajectories, which represent individuals who were arrested most often during the study period, nearly every member of these higher-frequency arrest groups visited the ED at least once (i.e.,

92.4% of increasing arrest, 96% of high arrest). We also see in Table 3 that 30.4% of the total arrest sample, and less than 30% of either low/zero arrest trajectory, visited the ED five or more times during the study period – compared to 59.3% of the increasing arrest and 73.1% of the high arrest trajectory groups. These disparities are stark and demonstrate that disproportionately more people who make frequent contact with the criminal justice system also contact the ED – and do so more often than their peers arrested less frequently.

A review of the ED use trajectories yields similar findings. We see in Table 5 that roughly 3% of either low ED trajectory were arrested at least once, compared to 15.2% of the mid ED group and 24.7% of the high ED group. In terms of repeat arrests, less than 1% of either lower-order group were arrested five or more times compared to 3.5% of the mid ED and 7% of the high ED groups.

Significantly more members of the most frequent arrest trajectory visited the ED, and visited more often, than those in lower-rate arrest trajectories. The same can be said for ED use – more individuals with frequent ED use also were arrested, and were arrested more often, than their peers who visited the ED less frequently. Together, these findings confirm H2 and argue that individuals with frequent contact with one system are disproportionately represented in groups characterized by frequent contact with the other.

### **[RQ5] Predicting Joint Trajectory Group Membership**

Research question 5 asks what demographic, health- and justice-related factors predict membership in the most problematic joint arrest/ED trajectory groups. Stepping back for a moment, Table 7 includes an overall description of each of the four most frequently cross-system involved joint trajectory groups (i.e., High arrest/High ED;

Increasing arrest/High ED; High arrest/Mid ED; Increasing arrest/Mid ED), and for the low arrest/low ED joint group as a reference. While the four most frequent groups are included in the descriptive table, the focus of the following interpretation and analyses will be on the two most “frequent” joint groups – high arrest/high ED and increasing arrest/high ED. Discussion of every single joint group, even those approaching the most frequent, is likely of interest to researchers and practitioners but it is outside of the scope of the current dissertation.

By summing individuals across these four categories we learn that 613 people, or 0.1% of the total sample (N=424,845), were members of the most problematic joint trajectories. These individuals represent 2.3% of all arrestees (N=26,626) and 3.7% of all cross-system involved individuals (N=16,723). These are the “super users” or the “power few” of this population (Sherman, 2007).

### ***Brief Description of Joint Trajectory Groups***

First, to describe the extent of cross-system involvement for the two most frequently involved groups, members of the high arrest/high ED joint group [G12] (n=46) visited the ED an average of 56 times (SD=59.9) with a range from 22 to 338 visits in five years. Individuals in this group were arrested an average of 23.3 times (SD=20.4) with a range from 9 to 124 arrests. Individuals in the increasing arrest/high ED joint group visited the ED a mean of 44.7 times (SD=44.1) with a range from 22 to 320 visits; and were arrested a mean of 11 times (SD=4.6) with a range from 5 to 25 arrests.

Like with the trajectory group comparisons discussed previously, columns are included in Table 7 to indicate what between-group differences (i.e., results of chi-square and ANOVA) were statistically significant. As indicated in the column labeled ‘G12 vs.

G11', a significantly larger proportion of the high arrest/high ED joint trajectory [G12] visited the ED to address all health issues included in the table when compared to low arrest/low ED [G11], with the exception of STIs (not significant). In terms of arrest, significantly more members of the high arrest/high ED group were arrested at least once for all offense types when compared to low arrest/low ED except for weapons offenses (not significant). A significantly larger proportion of the high arrest/high ED group was black and Hispanic; and members of this trajectory were older on average than those in the low arrest/low ED group.

Referring to the column labeled 'G13 vs. G11', between-group differences for all health issues in the table were significant including STIs; and for all offense types including weapons. The increasing arrest/high ED [G13] group is therefore slightly *more different* from the low arrest/low ED than members of the high arrest/high ED trajectory group. In terms of demographics, significantly lower proportion of the increasing arrest/high ED trajectory, when compared to low arrest/low ED, were male and white.

It is important to note that all individuals described in Table 7 are cross-system involved to some extent. That is, even the comparison group of low arrest/low ED still represents people that made contact with the ED and the criminal justice system during the same 5-year period of time. Because the most frequently cross-system involved groups both differed significantly from the low arrest/low ED group on a range of factors, we can determine that cross-system involvement is not alone a sufficient indicator of worse health or offending patterns. As this behavior becomes more frequent, distinct patterns of needs emerge.

As indicated in the column labeled ‘G12 vs. G13’, the two most frequently cross-system involved groups differed (albeit not significantly) on a handful of factors, indicating that these are also distinct groups of individuals with unique clusters of need despite both representing the ‘high ED’ trajectory [G10]. A significantly higher proportion of the high arrest/high ED group [G13] were ever arrested for prostitution. In fact, of the 61 members of the high arrest group (n=227) who were arrested for prostitution, 12 (or almost 20%) were also members of the high ED trajectory. Of the 12 people arrested for prostitution that were frequently cross-system involved (high/high), 11 of them were women.

Based on extent of ED use and arrest, one could perceive the following joint trajectory groups as three separate levels or tiers of cross-system involvement: low arrest/low ED [G11] (low); increasing arrest/mid ED [G15] (mid); and high arrest/high ED [G12] (high). The column labeled ‘G12 vs. G15’ shows results of between-group comparisons for the “mid” and “high” levels of cross-system involvement. These groups differed significantly on all health-related factors included in the table, and most criminal justice measures. Using this convention and looking across descriptive characteristics for all three “levels” we see that nearly all proportions and means increase in a linear fashion along with extent of cross-system involvement. For instance, the proportion of each joint group that visited the ED for a chronic condition is as follows: 12.7% for low, 30.1% for mid, and 71.1% for high. This is the case, again, for everything included in the table such as injuries, skin and dental conditions, anxiety, depression, suicide, comorbidity, prostitution arrests and property crime just to name a few. The only factors on which the

increasing arrest/mid ED group [G13] had a higher proportion or mean than the high arrest/high ED group [G12] was number of arrests and arrests for prostitution.

Risk ratios were also calculated to show the difference between these groups or “levels” of frequent cycling in terms of practical (versus statistical) significance. These values are listed in Table A11 in Appendix I. Looking at substance abuse, the risk of visiting the ED for drug- or alcohol-related reasons for individuals representing the “mid” level of frequent cycling [G15] was 79% greater than members of the group representing “low” [G11]; and individuals in the “high” level [G12] were 456% more likely to visit the ED for substance abuse when compared to “mid”. As for co-occurring mental illness and substance abuse, the “mid” level experienced a 31% greater risk of visiting the ED for both of these conditions when compared to “low”; and members of the “high” level faced 204% higher risk when compared to “mid”. This pattern of increasing risk across levels of frequent cycling was observed for many diagnoses and offense types in the table, particularly injuries, mental illness (not including substance abuse), anxiety, depression, suicide attempts and ideation, multimorbidity and arrest for prostitution. As individuals contact both systems more often, their burden of illness and disadvantage seems to increase across all domains. In other words, as cross-system involvement persists, nearly everything measured seems to get worse.

**Table 7. Demographic, Health- and Justice-Related Characteristics of Joint Arrest/ED Trajectory Groups: 4 Most “Frequent” Cross-System Involved Groups and Low Arrest/Low ED Group for Comparison**

<u>Measure</u>	Joint Trajectory Groups					G12 vs. G11	G13 vs. G11	G12 vs. G13	G12 vs. G15
	Joint [G11]	Joint [G12]	Joint [G13]	Joint [G14]	Joint [G15]				
	low arrest/ low ED (n=1,328)	high arrest/ high ED (n=46)	inc arrest/ high ED (n=104)	high arrest/ mid ED (n=107)	inc arrest/ mid ED (n=356)				
Age (years)	33.2 (11.2)	38.3 (11.4)	33.6 (10.3)	34.4 (10.3)	29.9 (9.9)	.003	.935	.493	***
18-21 years old	17.9%	2.2%	11.5%	10.3%	23.9%	.006	.102	.060	***
50-65 years old	8.7%	21.7%	8.7%	5.6%	5.9%	.003	.977	.026	***
Gender (male)	79.0%	67.4%	60.6%	70.1%	84.0%	.059	***	.426	.006
Race (black)	47.4%	63.0%	55.8%	43.9%	53.4%	.037	.102	.405	.215
Race (white)	29.2%	28.3%	17.3%	43.0%	26.4%	.888	.009	.127	.789
Ethnicity (Hispanic)	22.6%	8.7%	26.9%	13.1%	19.9%	.026	.311	.012	.065
Camden resident	61.1%	100%	96.2%	94.4%	88.5%	***	***	.178	.015
ED contacts (#)	2.7 (1.6)	56.0 (59.9)	44.7 (44.1)	12.3 (4.2)	11.6 (4.3)	***	***	.199	***
	<i>range</i>	<i>1-7</i>	<i>22-338</i>	<i>22-320</i>	<i>6-21</i>				
Abdominal pain	15.4%	67.4%	63.5%	28.0%	30.3%	***	***	.642	***
Chronic condition	12.7%	71.7%	65.4%	29.9%	30.1%	***	***	.444	***
3 or + chronic conditions	0.2%	13.0%	13.5%	4.7%	0.8%	***	***	.945	***
3 or + ED (chronic)	1.7%	45.7%	36.5%	8.4%	8.7%	***	***	.292	***
Dental	7.8%	45.7%	39.4%	21.5%	23.0%	***	***	.475	***
3 or + ED (dental)	1.1%	28.3%	22.1%	6.5%	7.6%	***	***	.416	***
Injuries	48.8%	95.7%	94.2%	78.5%	84.0%	***	***	.721	.035
3 or + ED (injuries)	9.2%	69.6%	69.2%	37.4%	41.3%	***	***	.967	***
Injuries (#)	0.9 (1.2)	7.0 (7.6)	7.1 (7.5)	2.5 (2.5)	2.6 (2.5)	***	***	.945	***
Skull-related injuries	1.5%	32.6%	16.4%	14.0%	9.0%	***	***	.025	***
Skin conditions	16.1%	78.3%	72.1%	58.9%	56.7%	***	***	.429	.005
3 or + ED (skin)	2.3%	54.4%	48.1%	18.7%	19.9%	***	***	.479	***

Poisoning/overdose	2.7%	21.7%	36.5%	26.2%	19.1%	***	***	.073	.670
3 or + ED (poisoning)	0.1%	10.9%	4.8%	8.4%	1.4%	***	***	.170	***
STI	4.7%	10.9%	18.3%	10.3%	21.1%	.060	***	.254	.103
Wounds	19.7%	80.4%	64.4%	47.7%	52.3%	***	***	.050	***
Mental health (excluding SA)	11.6%	76.1%	81.7%	42.1%	38.2%	***	***	.426	***
3 or + ED (MH exc. SA)	1.7%	52.2%	61.5%	24.3%	7.9%	***	***	.283	***
Mental health exc. SA (#)	0.2 (0.7)	8.5 (24.4)	8.1 (13.0)	1.4 (2.3)	0.9 (2.0)	***	***	.922	***
Anxiety	3.8%	52.2%	54.8%	18.7%	15.2%	***	***	.765	***
Bipolar	0.8%	13.0%	16.4%	4.7%	2.0%	***	***	.605	***
Depression	3.2%	47.8%	49.0%	20.6%	13.2%	***	***	.891	***
Schizophrenia	1.1%	21.7%	25.0%	8.4%	3.9%	***	***	.666	***
Suicide	1.2%	32.6%	36.5%	11.2%	7.0%	***	***	.642	***
Substance abuse	13.5%	91.3%	77.9%	74.8%	51.7%	***	***	.049	***
3 or + ED (SA)	1.0%	84.8%	61.5%	43.9%	25.3%	***	***	.005	***
Substance abuse (#)	0.2 (0.6)	14.0 (39.2)	6.8 (9.3)	3.1 (3.5)	1.7 (2.6)	***	***	.018	***
Co-occurring MH & SA	4.4%	76.1%	70.2%	39.3%	27.3%	***	***	.458	***
Chronic conditions + SA	2.0%	67.4%	51.9%	22.4%	21.4%	***	***	.008	***
Chronic conditions + SA + MH	0.5%	58.7%	44.2%	11.2%	13.2%	***	***	.102	***
Arrests (#)	2.0 (1.7)	23.3 (20.4)	11.1 (4.6)	19.5 (9.9)	11.0 (4.4)	***	***	***	***
	<i>range</i>	<i>1-20</i>	<i>9-124</i>	<i>5-25</i>	<i>8-59</i>				
Disorderly arrest	36.1%	93.5%	93.3%	96.3%	81.5%	***	***	.962	.042
Disorderly arrests (#)	0.4 (0.7)	10.0 (16.3)	3.8 (3.1)	6.2 (5.8)	2.5 (2.3)	***	***	.016	***
Drug arrest	32.5%	69.6%	56.7%	81.3%	78.9%	***	***	.138	.150
Drug arrests (#)	0.5 (1.0)	2.9 (3.3)	1.6 (2.1)	3.7 (3.3)	2.9 (2.9)	***	***	.020	.821
Property arrest	3.5%	41.3%	32.7%	38.3%	25.0%	***	***	.309	.019
Prostitution arrest	0.7%	26.1%	3.9%	25.2%	3.1%	***	***	***	***
Violent crime arrest	9.5%	21.7%	32.7%	27.1%	23.9%	.006	***	.174	.748
3 or + arrests (violent)	0.2%	0.0%	5.8%	2.8%	1.7%	.747	***	.096	.375
Weapons arrest	3.5%	6.5%	9.6%	7.5%	10.7%	.272	.002	.535	.381

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\*\*\*  $p < .001$  (Bonferroni correction  $.05/48$  comparisons =  $.001$ )

Controlled for age in final trajectory models for the full adult sample.

Percentages (%) represent proportion of group with 'yes' on a dichotomous measure. For continuous measures, group means and (standard deviations) are presented.

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### ***Factors Predicting Frequent Cross-System Involvement***

RQ5 asks what factors predict joint trajectory group membership. This question is broad but is asked with a focus on what differentiates frequent cross-system involvement from more sporadic cross-system contact. The goal of this question was to determine key drivers of frequent cross-system involvement in order to inform programming and policy around what to target to prevent the most harmful patterns of cross-system cycling.

First, the high arrest/high ED group comprised only 46 people; and increasing arrest/high ED represented 104. Because of small sample sizes for these joint trajectories, there were issues with logistic regression models that considered these groups separately. Based on between-group comparisons, I determined that the high arrest/high ED group and increasing arrest/high ED group were similar enough to combine into a common “frequent users” group – which overcame the sample size limitation and allowed these research questions to be answered using the original methodology proposed.

Turning to specific hypotheses, H3 proposed that any visit to the ED for a mood disorder (i.e., depression or bipolar), for schizophrenia, for substance abuse, or for co-occurring mental health and substance abuse would predict membership in a “frequent/frequent” joint trajectory group over a low/low joint group. In terms of physical health, H4 proposed that any visit to the ED for a chronic condition, and visiting the ED for multiple chronic conditions, would each predict frequent cross-system involvement. Table 8 includes results of the logistic regression model that addressed these specific hypotheses together.

First, while included as a control for race, being black did predict membership in a frequent cross-system involved group. This variable was significant even with a range

of health conditions included in the same model. Next, controlling for relevant demographics, we find partial support for these hypotheses. Regarding H3, visiting the ED for depression, substance abuse, and co-occurring mental health and substance abuse each independently increased one’s odds of membership in a frequent cross-system involved joint group over low arrest/low ED. The association between group membership, and bipolar and schizophrenia, were not significant. In response to H4, visiting the ED for a chronic condition, and for three or more different chronic conditions, each increased one’s odds of membership in the frequent arrest/frequent ED joint group over low arrest/low ED.

**Table 8.** Binary Logistic Regression: Predicting Frequent Cross-System Involvement

Predictor	Frequent Cross-System Involved Group [G12 & G13] (n=150)			
	<i>B (SE)</i>	<i>OR</i>	<i>sig</i>	
Age (years)	-0.05 (0.01)	0.95	.001	***
Gender (male)	-1.14 (0.31)	0.32	< .001	***
Black	1.91 (0.41)	6.74	< .001	***
Hispanic	1.63 (0.43)	5.09	< .001	***
ED – depression (ever)	1.55 (0.39)	4.73	< .001	***
ED – bipolar (ever)	-0.11 (0.63)	0.89	.860	
ED – schizophrenia (ever)	0.85 (0.51)	2.35	.095	
ED – substance abuse (ever)	2.18 (0.40)	8.86	< .001	***
Co-occurring MH/SA (ever)	1.96 (0.44)	7.07	< .001	***
ED – chronic condition (ever)	2.66 (0.31)	14.28	< .001	***
ED – 3 or + chronic cond (ever)	2.49 (1.10)	12.12	.023	*
constant	-4.12 (0.56)	0.02	< .001	***
<i>Model x2 (df)</i>	582.10 (11)			
<i>Pseudo R2</i>	0.60			
<i>N</i>	1,478			

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

“Frequent Cross-System Involved Group” includes members of High arrest/High ED [G12] (n=46) and Increasing Arrest/High ED [G13] (n=104) joint trajectory groups.

Reference group is low/zero arrest (1)/low decreasing ED [G11] (n=1,328)

The next model included predictors representing substance abuse, co-occurring mental illness and substance abuse, chronic physical health conditions, arrests for violence, and arrests for drug charges. This model also controlled for relevant demographics, as well as any ED contact for depression – a potentially important consequence of cross-system involvement and mediator of health-related strain. Predictors for substance abuse, ED visits for a chronic condition, arrests for violence and drug charges were measured as the number of ED contacts/arrests over five years; and co-morbidity and ED for depression were binary (yes/no). Drug arrests and ED visits for substance abuse were included separately because one indicates personal issues with drugs or alcohol (ED use) and the other (drug arrests) could be related to sales or involvement with illegal substances for reasons other than personal use.

Even after controlling for relevant covariates and the other key factors, the results indicated that each of these targetable issues exerted a significant influence on one's likelihood of frequent cross-system involvement over sporadic cross-system contact. Specifically, with each additional ED contact for substance abuse, cross-system involved adults were 2.7 times more likely to frequently cycle between the ED and arrest (i.e., belong to either G12 or G13). Visiting the ED at least once for both mental illness and substance abuse – an indicator of comorbidity – increased one's odds by 5.2 times. With each additional arrest for violence, one's odds of frequent cross-system involvement also increased by 5.2 times. An increase in the number of ED visits for a chronic condition and in the number of arrests for drug offenses also independently increased one's odds of frequent cross-system involvement. Among controls, there was a significant relationship between being black and ever visiting the ED for depression, and frequent cycling. The

strongest predictor in the model (other than race) was co-occurring mental illness and substance abuse, implicating comorbidity again as an important driver of frequent cross-system involvement. Number of arrests for violence was the second-largest odds ratio followed by ED contact for depression.

**Table 9.** Binary Logistic Regression Model to Identify Independent Predictors of Frequent Cross-System Involvement [G12 & G13]

Predictor	Frequent Cross-System Involved Group [G12 & G13] (n=150)			
	B (SE)	OR	sig	
Age (years)	-0.04 (0.02)	0.96	.063	
Gender (male)	-1.15 (0.43)	0.32	.008	**
Black	1.76 (0.58)	5.80	.002	**
Hispanic	0.94 (0.65)	2.57	.147	
ED – depression (ever)	1.52 (0.55)	4.55	.006	**
ED – substance abuse (#)	0.98 (0.16)	2.67	.000	***
Co-occurring MH & SA (ever)	1.64 (0.55)	5.18	.003	**
ED – chronic condition (#)	0.68 (0.15)	1.98	.000	***
Arrest – drug charges (#)	0.60 (0.11)	1.81	.000	***
Arrest – violence (#)	1.64 (0.30)	5.16	.000	***
constant	-5.02 (0.84)	0.01	.000	***
<i>Model x2 (df)</i>	759.68 (10)			
<i>Pseudo R2</i>	0.78			
<i>N</i>	1,478			

\*\*\* p < .001; \*\* p < .01; \* p < .05

“Frequent Cross-System Involved Group” includes members of High arrest/High ED [G12] (n=46) and Increasing Arrest/High ED [G13] (n=104) joint trajectory groups.

Reference group is low/zero arrest (1)/low decreasing ED [G11] (n=1,328)

Taken together, the results discussed immediately above tell us that frequent cross-system involvement is differentiated from low-level cross-system cycling on issues related to substance abuse, exposure to violence, chronic physical health, and co-morbidity. With other relevant predictors included, schizophrenia and bipolar seem to have little impact on one’s odds of frequent cycling. Depression, however, remains a significant predictor in both models. Looking at drug arrests and ED use for drug abuse separately, this raises questions about the relationship between being around drugs in

either capacity (possession/sales and health issues from use/abuse) and an increase in one's odds of frequently cycling.

## **[RQ6] Arrest and ED Trajectories for Young Adult Subsample**

### *Describe young adult subsample*

The young adult subsample consists of people in the data who were 18 years of age during the first year of data collection (2010), regardless of the year in which they first made contact with either system. This represents 8,625 individuals, or 2.0% of the full sample, who aged from 18 to 22 years over the course of the 5-year study period (2010 to 2014). The purpose of the young adult sub-analyses was to reconsider trajectories of both ED use and arrest using an age-restricted sample that provides a rough control for not only age, but the many factors that accumulate as individuals get older such as the progression of existing illnesses, development of health conditions, and the impact of longer-term disadvantage. This sample is better suited to answer questions around health-related strain and the time-ordering of system contacts.

Table 10 includes a brief description of the total young adult sample in terms of demographics and system involvement. Nearly half (50.7%) of the young adult subsample were male, 29.2% black, and 5.7% Hispanic. ED visits for the young adult sample ranged from zero to 71 contacts. Among young adults that visited the ED at least once, the average number of contacts was 3.0 (SD=4.3). Turning to police contact, the number of arrests among young adults ranged from zero to 29 arrests with a mean of 2.6 arrests (SD=3.2) for young adults that were arrested at least once between 2010 and 2014.

**Table 10. Demographics and System Involvement for Young Adult Subsample**

<u>Measure</u>	YOUNG ADULT SUBSAMPLE (N=8,625)
Age (years) ^	20.0 (1.3)
Gender (male)	50.7%
Race (black)	29.2%
Race (white)	52.7%
Ethnicity (Hispanic)	5.7%
Ever ED	95.6%
5 or + ED contacts	15.6%
ED contacts (#)	2.9 (4.3)
	<i>range: 0-71</i>
ED contacts (#) – <i>among those with at least 1 ED contact</i>	3.0 (4.3)
Ever Arrest	11.4%
5 or + Arrests	1.7%
Arrests (#)	0.3 (1.4)
	<i>range: 0-29</i>
Arrests (#) – <i>among those with at least 1 Arrest</i>	2.6 (3.2)

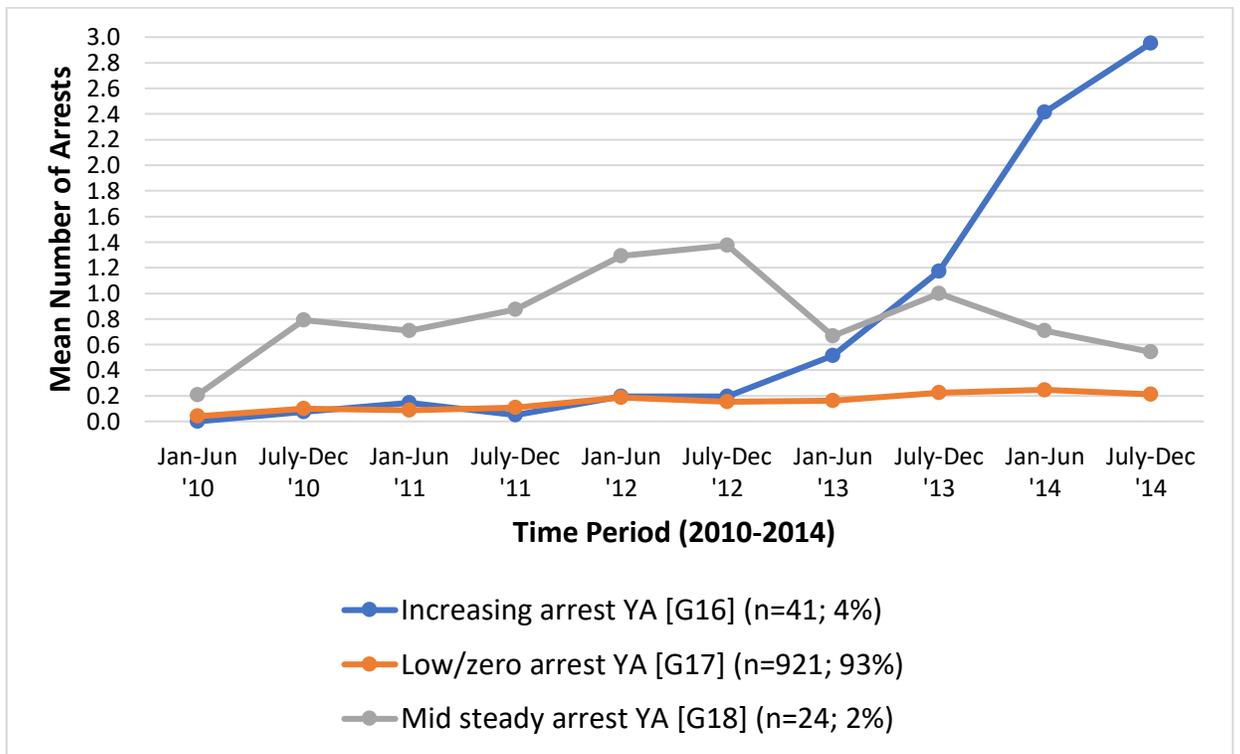
^ Age in this table only should be interpreted as average age of first contact with either system. Percentages (%) represent proportion of group with ‘yes’ on a dichotomous measure. For continuous measures, group means and (standard deviations) are presented.

***Group-based Trajectory Modeling – Young Adult Subsample***

This research question (RQ6) asks what arrest and ED use trajectories exist for a subsample of young adults only, during the same five-year period from 2010 to 2014. It was hypothesized that this group would demonstrate multiple distinct patterns of system despite their younger age (i.e., less time to contact systems and establish differentiation). RQ6 also asks how young adult trajectories compare to those for the full adult sample.

**Model selection: Arrest, Young Adult Subsample**

Beginning with the arrest trajectories, a total of 986 young adults (11.4% of the young adult subsample) were arrested at least once between 2010 and 2014 and therefore included in the analysis. Like with the full adult sample, zero cases were temporarily removed for both sets of group-based trajectory models (i.e., arrest and ED use) so only system-involved young adults were included in each model. The best-fitting group-based model for young adult arrest trajectories was a 3-group solution. A plot of the final young adult arrest model is included as Figure 4. This figure graphs the mean number of arrests during each six-month bin for each young adult arrest trajectory.



**Figure 4.** Mean (Observed) Number of Arrests for each Arrest Trajectory per Six-Month Time Period, Young Adult Subsample (n=986)

Like with the full sample, a series of models were run beginning with a 2-group solution and requesting one more group with each additional model until the BIC stopped

improving or the model did not converge. All groups in the first set of models were set to a cubic function. The BIC score was compared across models, with a lower BIC considered better or improved. Table A7 in Appendix H includes BIC values for each model, a basic description of groups, and group size for the four models run.

The BIC score improved between the 2- and 3-group solutions; but the BIC for the 4-group model was higher (i.e., not better) than that for the 3-group solution. Increasing the number of groups to 5 did yield an improved BIC over the 3- and 4-group solutions. The 6-group model generated a BIC value but did not display groups (i.e., returned an error from STATA) and no additional models were run.

The minimum group-size criteria of 1% was still in place for the young adult models; but was not a factor when selecting a best-fitting solution as all groups were larger than 1% of the total young adult subsample. When choosing between the 3- and 5-group solution, the rule of parsimony was considered. It was determined that the addition of groups from 3 to 5 was not warranted as it did not yield new information about varying degrees of arrest. In other words, the 5-group solution, with a slightly lower BIC score than the 3-group model, displayed more lower-order trajectories but there was little change in group size for the highest arrest trajectory (5.0% of the young adult subsample, versus 4.9%). Given the focus of the current study on higher-order or repeat system contacts and the difference between trajectories of varying degrees over time, the 3-group solution was chosen as best-fitting for these data.

As an additional consideration, not all groups were significant at the cubic function (i.e., did not follow a curvilinear shape). Once the 3-group solution was chosen, the functional form of each group was changed in subsequent models in order to

accommodate the correct shape of each trajectory. In the final 3-group model, trajectories 1 and 2 followed a linear function, and trajectory 3 a quadratic function. This iteration of group functional form (i.e., 112) was the best fit for these data as evidenced by the lowest BIC across the different 3-group solutions.

Individual trajectory group diagnostics for the 3-group young adult arrest model were satisfactory. The only measure that indicated a fit of less than “good” was the OCC for group 2 (3.97) slightly under the cut-off of 5. This was still seen as adequate; and OCC for this group did not improve past 5 in the 2- or 5-group solutions indicating that selecting a different model in pursuit of better individual group diagnostics was not an option. In fact, two groups in the 5-group solution had an AvePP and OCC below the cut-offs for “good”, compared to only one shortcoming in the 3-group solution. All model diagnostics considered for the final model including AvePP, average OCC and the difference between expected and total probabilities of membership in each trajectory are included in Table A8 in Appendix H.

### ***Describing final young adult arrest trajectories***

The final 3-group arrest model for individuals in the young adult subsample included one lower-order group near zero, one mid-level trajectory, and one pattern of increasing arrest that rose to represent the highest number of arrests toward the end of the five-year study period. Table 11 describes each young adult arrest trajectory in terms of demographics, reasons for ED contact, and reasons for arrest. As stated in the table, members of the lowest arrest trajectory (low/zero arrest) comprise the majority of young adults (93.4% of the young adult subsample). Members of the low/zero arrest trajectory [G17] were arrested an average of two times in five years (SD=1.8), and 59.1% visited

the ED. For the increasing arrest trajectory [G16], young adults were arrested an average of 10.8 times (SD=6.2) and 90.2% of this group visited the ED at least once. Lastly, individuals in the mid steady arrest trajectory [G18] reported a mean number of arrests of 11.5 (SD=4.1) and 91.7% visited the ED one or more times during the same period.

While individuals in the increasing arrest trajectory demonstrated a sharp increase in arrests (i.e., were arrested more often) during the last two years of the study period, the average number of arrests for this group over a five-year period is actually slightly less than the mean number of arrests for young adults in the mid steady arrest group. The difference between these two patterns is therefore not the number of times members were arrested over five years; but instead the fact that members of the increasing arrest group accumulated multiple arrests in a roughly two-year period while members of the mid steady arrest group were arrested roughly the same number of times during each of the five years of the study period.

The results in Table 11 yield interesting information about the two highest-order young adult arrest trajectories [G16 & G18]. For one, everyone in the mid steady arrest group [G18] were male and non-white. This trajectory also had the highest proportion of members ever arrested for a violent crime (29.2%) and for a weapons offense (20.8%). Many more members also visited the ED at least once to address an injury (77.3%) as well as skin conditions, wounds and STIs. While more than 80% of the mid steady arrest trajectory was arrested for a drug offense, this group represented the lowest proportion of members that visited the ED for a mental health condition (i.e., only 1 person); and no members of this group visited the ED for substance abuse issues including poisoning/overdose. This group could therefore represent individuals who engage in

violence, perhaps drug sales, and high-risk behavior, and experience health issues like injuries and STIs as a result. They do not present as many indicators of poor health when compared to the increasing arrest group.

The increasing arrest trajectory [G16], with a similar mean number of arrests over the study period as the mid steady arrest group, demonstrated a very different profile of needs. This group had the highest proportion of young adults that visited the ED for a chronic condition, for multiple skin conditions, mental illness, substance abuse and co-morbidity. These individuals were arrested less often for violence (lowest proportion across groups, 2.4%); and fewer visited the ED for injuries (lowest proportion across groups, 54.1%). This group, members of which were arrested roughly as often as those in the mid steady arrest group, seem to face more longer-term physical and behavioral health challenges and fewer issues related to violence and risk.

**Table 11.** *Demographic, Health- and Justice-Related Characteristics for each Arrest Trajectory, Young Adult Subsample (N=986)*

<u>Measure</u>	TOTAL ARREST SAMPLE (YA) (n=986)	<u>Young Adult (YA) Arrest Trajectory Groups</u>		
		Arrest [G16] Increasing arrest [G16] (YA) (n=41)	Arrest [G17] Low/zero arrest [G17] (YA) (n=921)	Arrest [G18] Mid steady arrest [G18] (YA) (n=24)
Age (years)	19.8 (1.4)	19.6 (1.2)	19.9 (1.4)	18.7 (0.6)
Gender (male)	77.3%	90.2%	76.1%	100%
Race (black)	41.5%	43.9%	40.5%	75.0%
Race (white)	31.5%	31.7%	32.4%	0%
Ethnicity (Hispanic)	26.3%	24.4%	26.4%	25%
Ever ED contact	61.2%	90.2%	59.1%	91.7%
5 or + ED contacts	28.1%	48.8%	26.8%	41.7%
ED contacts (#)	3.7 (5.8)	7.2 (7.8)	3.5 (5.6)	5.9 (5.7)

	<i>range</i>	0-45	0-31	0-45	0-18
Arrests (#)		2.6 (3.2)	10.8 (6.2)	2.0 (1.8)	11.5 (4.1)
	<i>range</i>	1-29	4-29	1-17	6-23
Disorderly arrest		45.3%	82.9%	42.8%	79.2%
Disorderly arrests (#)		0.6 (0.9)	2.2 (2.3)	0.5 (0.6)	1.5 (1.4)
Drug arrest		36.7%	80.5%	33.4%	87.5%
Drug arrests (#)		0.8 (1.6)	3.3 (3.3)	0.6 (1.2)	4.1 (3.3)
Property arrest		8%	12.2%	7.3%	29.2%
Prostitution arrest		0.4%	2.4%	0.3%	0%
Violent crime arrest		12.6%	2.4%	12.6%	29.2%
3 or + arrests (violent)		0.3%	0%	0.3%	0%
Weapons arrest		5.3%	9.8%	4.7%	20.8%

***BELOW – only individuals in each group that visited the ED at least once***

	(n=603)	(n=37)	(n=544)	(n=22)
ED contacts (#)	6.1 (6.4)	7.9 (7.8)	6.0 (6.3)	6.5 (5.6)
Abdominal pain	25.5%	13.5%	27.2%	4.6%
Chronic condition	12.6%	21.6%	12.5%	0%
3 or + chronic conditions	0.2%	0%	0.2%	0%
Dental	11.3%	8.1%	11.6%	9.1%
3 or + ED (dental)	1.8%	2.7%	1.7%	4.6%
Injuries	56.7%	54.1%	56.1%	77.3%
3 or + ED (injuries)	21.2%	10.8%	21.7%	27.3%
Injuries (#)	1.5 (2.1)	1.0 (1.5)	1.5 (2.2)	2.3 (2.8)
Skull-related injuries	3.7%	2.7%	3.7%	4.6%
Skin conditions	25.4%	32.4%	24.1%	45.5%
3 or + ED (skin)	5.1%	16.2%	4%	13.6%
Poisoning/overdose	7.6%	21.6%	7%	0%
3 or + ED (poisoning)	0.3%	0%	0.4%	0%
STI	16.6%	16.2%	15.6%	41%
Wounds	27.7%	46%	25.4%	54.6%
Mental health (excluding SA)	14.4%	13.5%	14.9%	4.6%
3 or + ED (MH exc. SA)	5.1%	8.1%	5%	4.6%
Mental health exc. SA (#)	0.4 (1.7)	0.6 (1.9)	0.4 (1.6)	0.3 (1.5)
Anxiety	6.3%	8.1%	6.3%	4.6%
Bipolar	1.7%	0%	1.7%	4.6%
Depression	4.5%	8.1%	4.2%	4.6%
Schizophrenia	1.8%	5.4%	1.7%	0%
Suicide	2.3%	5.4%	2.2%	0%
Substance abuse	17.1%	27%	17.1%	0%
3 or + ED (SA)	5.1%	16.2%	4.6%	0%

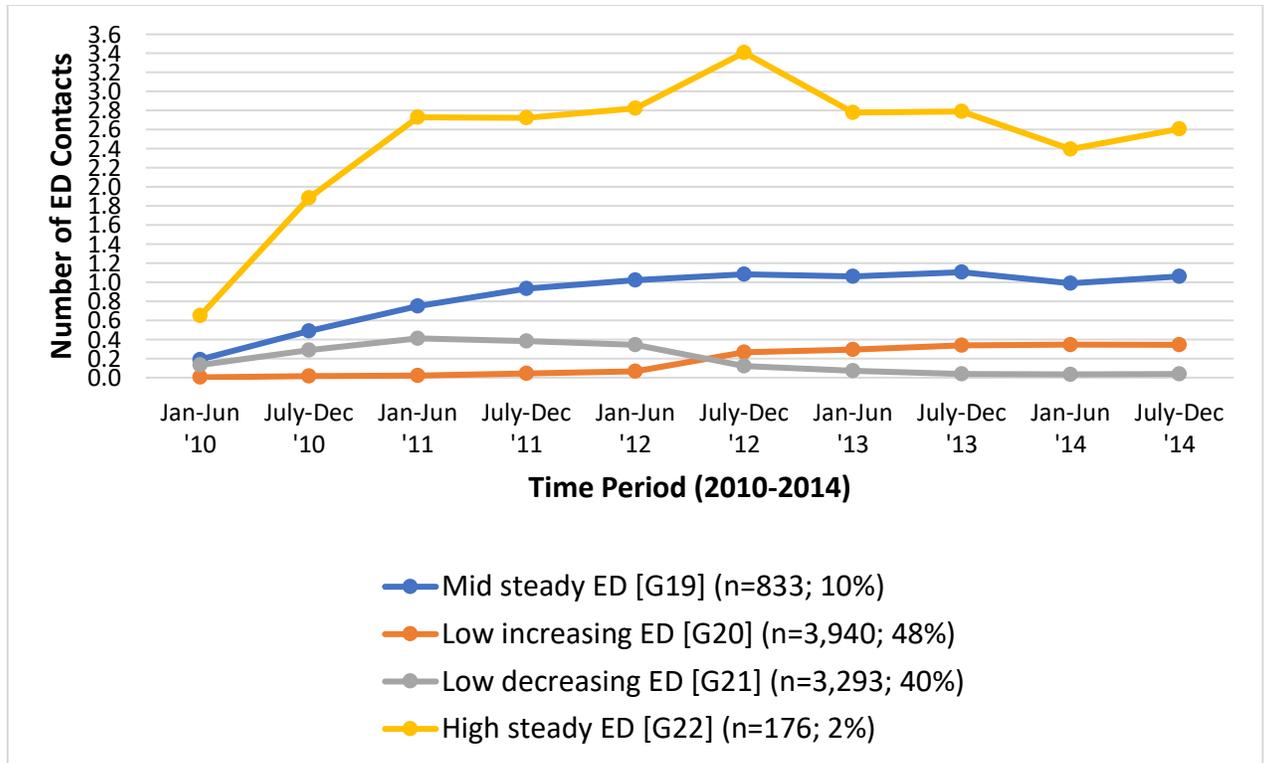
Substance abuse (#)	0.4 (1.1)	1.2 (2.3)	0.3 (1.0)	0 (0)
Co-occurring MH & SA	6.6%	10.8%	6.6%	0%
Chronic conditions + SA	3.2%	13.5%	2.6%	0%
Chronic conditions + SA + MH	1.3%	5.4%	1.1%	0%

Percentages (%) represent proportion of group with “yes” on dichotomous measure. For continuous measures, group means and (standard deviations) are presented. The greyed-out column labeled ‘TOTAL ARREST SAMPLE (YA)’ is included for comparison.

Only 1 person in Group 3 visited the ED for a mental health-related reason.

***Model selection: ED Visits, Young Adult Subsample***

Turning now to the ED trajectory model for the young adult subsample, with all zero cases removed, analyses included 8,242 individuals – or everyone who visited the ED at least once between 2010 and 2014 (95.6% of the total young adult subsample). The final model includes a 4-group solution with a high ED trajectory, a steady mid-level trajectory, and two lower-order groups near zero. A plot of the mean number of ED visits per six-month bin for each young adult ED trajectory in the final 4-group solution is included in Figure 5.



**Figure 5.** Mean (Observed) Number of ED Contacts for each ED Trajectory per Six-Month Time Period, Young Adult Subsample (n=8,242)

A series of group-based models were run, beginning with a 2-group solution and adding groups until the BIC value stopped improving. While the BIC continued to improve with the addition of groups up to an 8-group solution, the minimum group-size criteria of 1% was violated beginning with the 7-group solution. The 6-group model had adequate group size but generated an error from STATA that the variance matrix was nonsymmetrical. Working backwards, this left the 5-group model as that with the lowest BIC and adequate size for each trajectory group. Comparing the 4- and 5-group solutions and considering parsimony, however, it was determined that the addition of a group in the 5-group solution did not contribute new information about the extent of ED use by young adults over time. The only difference between the 4- and 5-group models was the emergence in the 5-group solution of an additional lower-order group just above zero.

There was no change to the size of the highest ED trajectory present in the 4-group model. For this reason, the 4-group solution was considered final. Table A9 in Appendix H lists the BIC scores for each basic model run, as well as brief trajectory descriptions and the proportion of the total young adult sample in each.

Looking to functional form, not all groups were significant at a cubic function in the basic trajectory model. To accommodate, the group that was not significant at a cubic function was changed to a quadratic function, at which point that group was significant. The final 4-group solution therefore reports 3 groups at a cubic function and one at quadratic. Accommodating for appropriate functional form allowed for the distinct mid-level trajectory to emerge from the lower-order cluster of groups in the model with all groups at the cubic function.

Individual group diagnostics (i.e., AvePP, OCC, difference between expected and observed probabilities) were deemed adequate for the 4-group solution. Table A10 in Appendix H lists the model diagnostics considered for each trajectory in the final model including AvePP, average OCC and the difference between expected and total probabilities of membership. As stated in the table, the only measure that did not reach the cut-off for “good” was the OCC for the low increasing ED group [G20] (3.93). It should be noted that, in the 5-group solution, there were issues with individual group diagnostics for 3 of the 5 groups including AvePP and OCC values less than the cut-off for “good”. Adding groups to the model therefore did not improve upon the accuracy of trajectory assignment, further supporting the decision to settle on the 4-group model as the final solution.

### *Describing final young adult ED use trajectories*

Key demographic factors, reasons for ED use and reasons for arrest are included for each young adult ED trajectory group are included in Table 12. From this table we see that the high steady ED group for young adults [G22] represented the youngest mean age across groups (18.6 years) just like with the high ED trajectory for the full sample [G10] (youngest mean age). The high group [G22] also had the largest proportion of members that were ever arrested (27.3%) and arrested five or more times (6.8%) – yet another piece of evidence to support the strong relationship between repeat arrest and repeat ED contacts. A majority of the high young adult ED trajectory were black (55.7%), visited the ED for abdominal pain (81.8%), injuries (85.2%), multiple injuries (52.8%) and skin conditions (63.6%). Also like with the full sample and both arrest trajectory models, prevalence of ED contact for all health-related issues in the table increased across “levels” of ED use for the young adult sample from low to mid to high. Lastly, the young adult ED trajectories were remarkably similar to those for the full sample in terms of shape and size of each group relative to the total sample.

**Table 12. Demographic, Health- and Justice-Related Characteristics for each ED Trajectory, Young Adult Subsample (N=8,242)**

<u>Measure</u>	Young Adult (YA) ED Trajectory Groups				
	TOTAL ED SAMPLE (YA) (N=8,242)	ED [G19]	ED [G20]	ED [G21]	ED [G22]
		Mid steady ED (YA) (n=833)	Low increase ED (YA) (n=3,940)	Low decrease ED (YA) (n=3,293)	High steady ED (YA) (n=176)
Age (years)	20.0 (1.3)	19.0 (0.8)	21.1 (1.0)	19.1 (0.7)	18.6 (0.5)
Gender (male)	50.7%	34%	52.6%	51.1%	21%
Race (black)	29.1%	45.9%	25.6%	27.5%	55.7%
Race (white)	52.7%	29.2%	56.6%	56.8%	17.6%
Ethnicity (Hispanic)	5.7%	9%	4.2%	4.1%	14.2%
ED contacts (#)	2.9 (4.3)	8.7 (2.9)	1.7 (1.2)	1.9 (1.3)	24.8 (9.8)
<i>range</i>	1-71	5-17	1-7	1-9	16-71
Ever Arrest	11.4%	20.8%	5.1%	5.5%	27.3%
5 or + Arrests	1.6%	4.8%	0.9%	1.2%	6.8%
Abdominal pain	23.4%	57.1%	18.0%	20.9%	81.8%
Chronic condition	7.5%	21.1%	5.2%	5%	39.8%
3 or + chronic conditions	0.1%	0.6%	0%	0%	0.6%
Dental	5.0%	15%	3.4%	3.3%	35.2%
3 or + ED (dental)	1.1%	4.3%	0.4%	0.3%	14.8%
Injuries	37.6%	66.4%	32.1%	38.8%	85.2%
3 or + ED (injuries)	7.7%	28.5%	3.6%	5.1%	52.8%
Injuries (#)	0.7 (1.4)	1.8 (2.0)	0.5 (0.9)	0.6 (1.0)	3.8 (4.0)
Skull-related injuries	1.2%	2.6%	1%	1%	3.4%
Skin conditions	13.2%	36.3%	9.9%	10%	63.6%
3 or + ED (skin)	7.7%	9.6%	0.6%	0.8%	23.3%
Poisoning/overdose	2.3%	5.4%	1.7%	1.6%	10.8%
3 or + ED (poisoning)	0.1%	0.1%	0.1%	0.1%	1.1%
STI	3.3%	12.2%	1.4%	2.3%	29%
Wounds	13.2%	25.2%	11.1%	12.6%	42.1%
Mental health (excluding SA)	9.8%	22.7%	7.4%	7.7%	42.6%
3 or + ED (MH exc. SA)	2.3%	7.7%	1.1%	1.6%	17.1%
Mental health exc. SA (#)	0.2 (1.0)	0.6 (1.6)	0.1 (0.5)	0.1 (0.6)	1.6 (3.8)
Anxiety	4.3%	10.4%	3.6%	3.2%	21.6%
Bipolar	1%	2.4%	0.5%	0.9%	8%

Depression	2.5%	5.9%	1.7%	2.4%	13.1%
Schizophrenia	0.7%	1.6%	0.4%	0.9%	4.6%
Suicide	1.2%	2.9%	0.8%	1%	7.4%
Substance abuse	4.7%	10.1%	4%	4%	17.1%
3 or + ED (SA)	0.7%	3%	0.3%	0.3%	5.1%
Substance abuse (#)	0.1 (0.5)	0.2 (0.9)	0.1 (0.3)	0.1 (0.3)	0.4 (1.3)
Co-occurring MH & SA	1.9%	5.9%	1.1%	1.3%	13.1%
Chronic conditions + SA	0.7%	2.5%	0.3%	0.3%	7.4%
Chronic conditions + SA + MH	0.4%	1.6%	0.1%	0.1%	5.7%
<b><i>BELOW - only individuals in each group that were arrested at least once</i></b>					
	(n=603)	(n=173)	(n=201)	(n=181)	(n=48)
Arrests (#)	3.3 (3.7)	3.5 (4.1)	2.9 (2.9)	3.4 (3.9)	4.0 (4.4)
<i>range</i>	1-29	1-29	1-20	1-27	1-16
Disorderly arrest	45.3%	43.9%	40.8%	40.9%	60.4%
Disorderly arrests (#)	0.1 (0.3)	0.7 (1.1)	0.6 (1.1)	0.5 (0.7)	1.0 (1.2)
Drug arrest	36.7%	39.3%	40.8%	45.9%	31.3%
Drug arrests (#)	1.0 (1.8)	1.1 (1.9)	0.9 (1.5)	1.2 (2.1)	0.8 (1.5)
Property arrest	8.0%	10.4%	8%	11.6%	16.7%
Prostitution arrest	0.2%	0.6%	0.5%	0%	0%
Violent crime arrest	15.1%	19.1%	10.0%	13.3%	29.2%
3 or + arrests (violent)	0.3%	0%	0%	1.1%	0%
Weapons arrest	5.3%	6.9%	4.5%	11.6%	4.2%

Percentages (%) represent proportion of group with “yes” on dichotomous measure. For continuous measures, group means and (standard deviations) are presented.

The greyed-out column labeled ‘TOTAL ED SAMPLE (YA)’ is included for comparison.

To address the final component of RQ6 and beginning with ED, we see by visually comparing the groups in Figure 2 to those in Figure 5 that ED trajectories for the young adult subsample look remarkably similar to those followed by individuals in the full adult sample. In both models, there are two lower-order trajectories that hover just above zero, one increasing and the other decreasing slightly over time. Both trajectory models also include a mid ED trajectory representing consistent, mid-level ED visits across five years. The most frequent trajectory for both the full adult sample and for young adults represents a pattern of steady and frequent ED visits over time. One

conclusion that can be drawn from this visual comparison is that patterns of ED use, or misuse, are established early on in an individual's adult life. The higher-order trajectories in either model are also stable over time (i.e., roughly the same number of ED contacts during each of the five years for both groups). This argues for consistency in ED use for individuals who contact the ED more often, even for people much younger in age.

Rates of ED contact for chronic conditions, wounds, substance abuse and all co-morbidity measures were much lower across groups for the young adult ED trajectories when compared to the full sample. This implies that these issues accumulate and/or begin to impact more people as individuals age. On the other hand, the young adult ED trajectories reported more contact for STIs; and more arrests for violent and weapons offenses. These issues are more indicative of younger age and therefore makes sense.

The high ED trajectory for young adults and the full sample were similar in key ways as well. For one, both have the youngest mean age across ED trajectories, both are roughly half black, and both represent more women than the other ED trajectories. Interesting in their similarity, 80% of both high ED groups visited for abdominal pain, roughly 35% for dental issues, about 90% for injuries, approximately 60% for skin conditions, and roughly 40% for wounds. This was taken to mean that for some health-related issues, ED contact begins early in life and/or does not depend on age.

When comparing young adult and full adult arrest trajectories, the most prominent finding is that younger adults follow fewer distinct patterns through arrest than older adults. The two highest-order arrest trajectories for young adults are more distinct from each other in terms of health-related issues and reasons for arrest than those for the full adult sample. In sum, we find that not only do young adults follow distinct patterns

through either system over time, but even at 18 years of age individuals can achieve a level of “frequent” contact, especially with the ED. Some issues like skin conditions and injuries were equally prevalent for members of the young adult high ED trajectory when compared to the full sample high ED group; while others like substance abuse and co-morbidity grow in prevalence as people age.

Turning to a rough exploration of time-ordering between ED use and arrest for young adults, Table 13 displays the results of binary logistic regression models that examined any ED contact during each year separately.

**Table 13.** Binary Logistic Regression Models Using ED Contact during each Year (1-5) to Predict Membership in Higher Arrest Trajectories, Young Adult Subsample

Predictor	Young Adult Arrest Trajectories					
	Increasing Arrest [G16] (n=41)			Mid Steady Arrest [G18] (n=24)		
	B (SE)	OR	sig	B (SE)	OR	sig
ED – <b>Year 1</b> (ever)	-0.35 (0.44)	0.70	.420	0.57 (0.48)	1.77	.232
ED – <b>Year 2</b> (ever)	-0.56 (0.39)	0.57	.150	0.28 (0.50)	1.31	.579
ED – <b>Year 3</b> (ever)	0.18 (0.38)	1.20	.638	1.24 (0.51)	3.46	.016 *
ED – <b>Year 4</b> (ever)	1.32 (0.40)	3.74	.001 ***	-0.71 (0.50)	0.49	.159
ED – <b>Year 5</b> (ever)	0.77 (0.38)	2.22	.036 *	0.35 (0.48)	1.42	.466
constant	-3.94 (0.30)	0.02	.000 ***	-4.42 (0.38)	0.01	.000 ***
<i>Model x2 (df)</i>	27.49 (5)			14.27 (5)		
<i>Pseudo R2</i>	0.08			0.06		
<i>N</i>	962			945		

\*\*\* p < .001; \*\* p < .01; \* p < .05  
Reference group is Low/Zero Arrest trajectory [G17] (n=921)

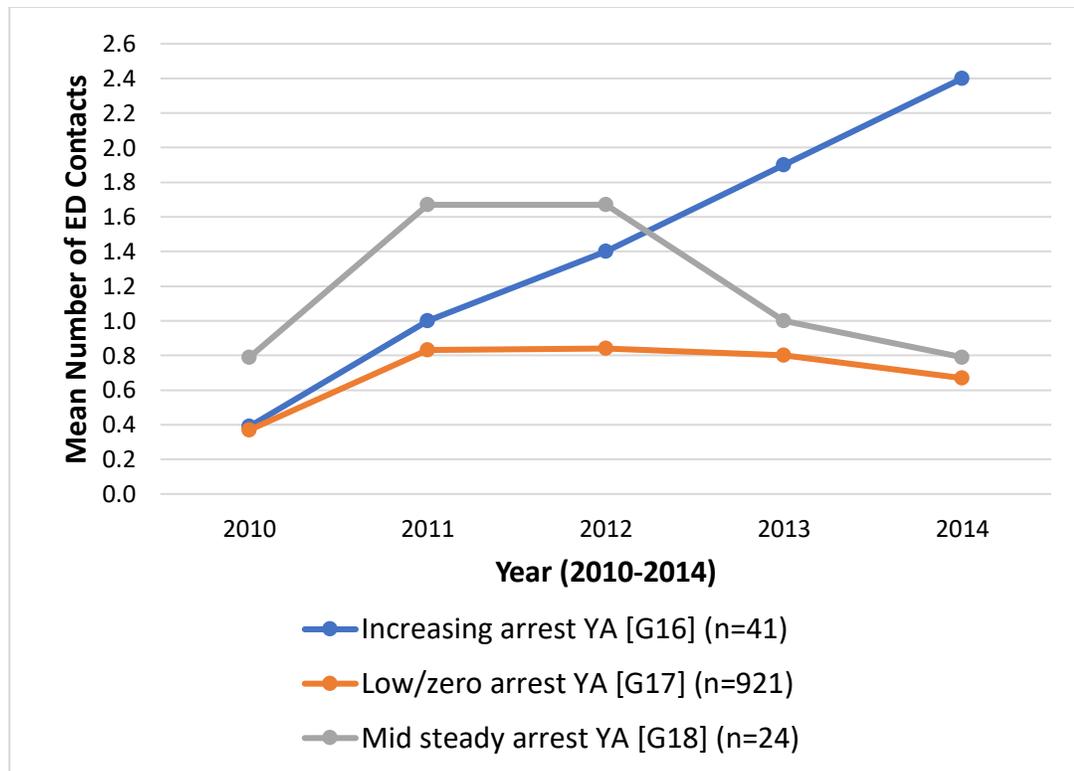
As reflected in a table in Appendix E, young adults in the mid steady arrest trajectory [G18] began getting arrested, as a group, in year 1 and maintained a mean of at least 1 arrest for all five years of data. During year 3, this group experienced its highest mean number of arrests (M=2.7, SD=1.6) followed by year 4 (M=1.7, SD=2.0).

According to the model in Table 13, visiting the ED in year 3 increased a young adult’s

odds of being in the mid steady arrest trajectory by 3.5 times. No other years were statistically significant. If ED use (thus health strain) predicted arrest in general, we would expect to see significance in this model for all five years for this group. Instead, the impact was only observed during the year in which this group was arrested most often (year 3). This could mean that health strain is a better predictor of an increase in offending than of offending in general, at least among younger individuals.

A relationship between ED contact and arrest was also found for the increasing arrest group [16]. Members of the young adult increasing arrest trajectory began the data period with few/no arrests then started getting arrested often, as a group, during years 4 (M=1.7,SD=2.2) and 5 (M=5.4, SD=2.8). Visiting the ED in years 4 and 5 (only) significantly increased a young adult's odds of being in the increasing arrest trajectory by roughly 3 times. Controlling for ED contact during each year individually, visiting the ED (a proxy for health-related strain) therefore had an impact on higher rates of arrest.

A series of means plots were generated to make this point. Figure 6 charts the mean number of ED visits for each young adult arrest trajectory during each of the five years of data. In this figure we see that the increasing arrest trajectory [G16] follows a similarly increasing pattern of ED visits during the same period. The mid steady arrest trajectory [G18] follows a similarly mid-level ED use trajectory. The lowest arrest trajectory [G17] also represents the lowest rate of ED use over the study period. Visually, the arrest trajectories seem very similar to those followed by the same individuals through the ED, during the same period of time.



**Figure 6.** Mean Number of ED Contacts for each Arrest Trajectory per Year, Young Adult Subsample (n=986)

Referring back to Figure 4, young adults in the increasing arrest trajectory [G16] experienced the highest mean number of arrests during years 4 (1.7 arrests) and 5 (5.4 arrests). These are the same years in which any ED contact predicted membership in the increasing arrest group. It is also during these same years that members of the increasing arrest trajectory reported the highest mean number of ED contacts (1.9 visits in year 4; 2.4 visits in year 5). Similarly, members of the mid steady arrest trajectory [G18] had the highest mean number of arrests during year 3 (M= 2.7 arrests) – the same year in which this group reported the highest number of ED visits (M=1.7 ED visits); and in which any ED contact predicted membership in this trajectory group. This indicates that, for young adults in this sample, there is some relationship between visiting the ED in a given year

and being arrested more often during that same year. These findings also suggest that, among young adults, periods of repeat arrest and repeat ED use co-occur in time.

When looking at cross-system contact more generally (i.e., not a focus on repeat arrest/ED use), it appears that contact with the ED preceded contact with police for young adults in this subsample. The mid/steady arrest trajectory began to get arrested, as a group, in year 2 – but had roughly one ED contact each during year 1. Similarly, the increasing arrest trajectory began getting arrested, as a group, during the second half of year 3 then experienced a sharp increase during years 4 and 5. According to Figure 4, the increasing arrest trajectory first contacted the ED between years 1 and 2. Again, this is just a visual comparison and not a true test of time-ordering. I also do not have data on juvenile arrests or hospital contacts which may tell a different story. Health-related strain literature argues that health-related issues (or ED contacts) precede justice system involvement (or arrest), the stress from which can trigger maladaptive coping, hence, crime (Agnew, 1992; 2001). Looking at the data in 12-month chunks, this could in fact be the case for this particular sample of young adults.

## CHAPTER 5: QUALITATIVE RESULTS

Semi-structured interviews were completed with a targeted sample of 6 providers in Camden or the nearby community. The purpose of these interviews was to elaborate upon the trajectory group descriptions by illuminating factors and mechanisms underlying cross-system involvement that were not measured by the quantitative data. Through their work, these providers have unique insights into the experiences of system-involved adults in Camden across relevant domains. Interviews lasted between 55 and 90 minutes. Four participants were female and two were male. Three participants are currently employed in the healthcare field; one in the criminal justice field; one in homelessness services; and one person works for a multidisciplinary program focused on health-vulnerable and low-income individuals with a caseload of frequent users. Five of six participants still interact with and provide direct service to clients/patients on a daily basis. Table 14 includes general information on each qualitative participant including domain of expertise, position title and length of time working in his or her field. In some cases, an individual's exact position was obscured to maintain confidentiality. All names were changed for the same purpose.

**Table 14.** *Description of Qualitative Participants*

Participant “name”	Domain	Position	City of Employment	Total time in Field (time in Position)
Anna	Criminal Justice	Jail Administrator	Camden	16 years (4 years)
Sam	Health	Emergency Medical Services (EMS) Manager	Camden	35 years (3 ½ years)
Mary	Health	MD/Associate Professor – emergency medicine	Philadelphia	9 years (6 years)
Susan	Health	RN & Community Health Educator	Camden	17 years (4 years)
Tara	Homelessness	Program Director – homeless shelter	Camden	20 years (3 years)
Bob	Multiple	Community Health Worker – frequent user program	Camden	2 years (2 years)

Contact was made with roughly 25 providers in the Camden community to determine interest and eligibility in participating in an interview. While most would have been eligible, the majority were too busy to participate. This was likely a function of reaching out to people with extensive experience, thus important positions that do not allow time for an interview.

Five of the six interviews took place in person at a location in the community – most often in the participant’s office. One interview was done through web conference (audio, video, screen sharing). Interviews took place during business hours while the participant was at work, or on a short break during the workday. All interviews were audio recorded and transcribed within two weeks post-interview.

Providers were shown the single and joint trajectory models/groups on a PowerPoint slide (graphed trajectories and descriptive tables), after which they often picked out individual diagnoses to discuss on their own – things of interest to them that stuck out as important. I also mentioned highlights from each trajectory solution to begin

the conversation. The results below are a brief overview of each important topic or theme that emerged from the qualitative interviews, organized by research question (RQ7). The ways in which the qualitative results dovetailed with the quantitative findings are not presented here but reserved for the Discussion chapter. This section serves more as an overview of what providers said in relation to cross-system involvement and the criminal justice/public health overlap. Together, these findings tell us a great deal about the groups that emerged and why some issues seem to disproportionately impact frequent users. Interviews also provided qualitative insights into the groups revealed during the trajectory analysis – pertinent, front-line information that could not have been obtained elsewhere or by other means.

### **[RQ7 Service Provider Insights into Trajectory Groups**

When asked “do any of these trajectories ring true?” (RQ7), providers mostly discussed what factors they felt differentiate frequent cyclers from other system-involved adults. Responses to this question were therefore better organized around the various factors they suggested. This section outlines the factors mentioned by providers and/or pulled out as important when discussing cross-system involvement.

#### ***Substance Abuse and Mental Illness***

Referring to the quantitative data, the most salient difference between members of the frequent cross-system involved groups and those with fewer system contacts is the higher prevalence of mental illness and substance abuse. Providers were shown group descriptions and this disparity was highlighted by everyone interviewed. As stated by Sam (EMS) immediately after reviewing the joint trajectory groups:

“I mean even before you showed me any of the data, I would have said that the leading cross-over between the 2 groups is mental health and substance abuse – and in this city they’re tied very closely together. There’s a lot of mental health patients with substance abuse issues. There’s a lot of substance abuse patients that have a mental health background as well.”

As this quote highlights, the primary theme that emerged across interviews when the topic of behavioral health came up was how often mental illness and substance abuse occur together. A physician in the ED cited addiction as a major driver of repeat ED contacts. When asked about the presence of mental illness, she said it would be “very rare” to see one without the other in a frequent user. Similarly, Bob the community health worker that services frequent users agreed that when someone has mental illness, it is always accompanied by substance abuse to some extent. Tara, the director of a homeless shelter, uses a triage tool in her work that identifies different levels of need. An interesting point around substance abuse and mental health emerged from her quote:

“We explain it to people that way – kind of the “sprained ankle” homeless person who, you know, maybe is drinking and got depressed and, you know, well maybe is drinking a lot and lost their apartment and so they’re homeless for the first time. Then there is the “chest pain” homeless person who is, you know, that – drinking and lost their apartment – and has also lost their job and, you know, has really gotten depressed and things. And then there is the “bleeder/got shot” homeless person who, as well as all those things, is very active in addition, serious mental health, has been homeless multiple times.”

As she describes them, members of each tier have co-occurring mental illness and substance abuse – but those in the most high-need group present with serious mental illness and long-term addiction. So at least in the context of homelessness, it is not just that these issues co-occur, but how serious each condition is and how long a person experiences them.

Considering mental illness separate from drug abuse, four of the six providers remarked at the high prevalence of depression and anxiety in the populations with which

they work. These issues are exacerbated by poor physical health, justice system involvement, homelessness and the many other issues experienced by frequent cyclers.

“I’m gonna be honest with you – almost every person has mental health. (...) Some people are worse than others. A lot just have anxiety, you know. Like their anxiety and stuff gets super bad and they get depressed and it’s a snowball effect.”

More serious mental health conditions like schizophrenia and bipolar were not emphasized by any providers – although the EMS worker did say it is something he encounters. When asked about the role of mental illness separate from substance abuse, most cited conditions like anxiety, depression, apathy, and that some people “can’t function in society” or “can’t take care of themselves” in lieu of an official diagnosis.

Taking substance abuse alone, all providers attributed cross-system cycling, at least to some extent, to drug abuse and addiction. Camden has a notoriously bad drug problem, particularly for opiates like heroin. Everyone mentioned opiate overdose as something they encounter in their work. The EMS official said it constitutes more than 20% of calls for services – a percentage that has increased every year. Regarding the challenge it poses to his employees, he stated:

“...we see them from 18 to 80 here in the city, and we always have to kind of be alert to the fact that, even though it might look like something, that there’s a high probability that there’s drugs also involved. It’s so prevalent here in the city.”

Two providers brought up drugs other than opiates: synthetic marijuana (K2 or “buddha bud”) and PCP. Use of these drugs is common in Camden and can cause individuals to gain the attention of police and the ED; but are not what long-term frequent users are addicted to.

Relevant to mental illness, trauma was mentioned by four providers, mostly in the context of prostitution. All have encountered individuals experiencing sexual and/or physical trauma and agreed it has a damaging impact on all aspects of a person’s life and

decision-making. Bob used the experience of trauma to explain some of the apathy he sees among people caught in a harmful cycling of system involvement that are still resistant to services.

“The ones that this has been their life, they’re kinda used to it so it’s not like...like if you’ve been dealing with a lot of trauma, new trauma is not as big a deal. If you haven’t, something traumatic might change how you move. But these people have been dealing with trauma so it’s normalized.”

### ***Physical health***

The quantitative results show that the prevalence of ED contact for certain physical health conditions increases significantly as the total number of system contacts (including arrest) increase. First, many more members of the higher-order single and joint trajectory groups visited the ED for skin-related issues. Four providers discussed skin conditions, all of whom tied it back to injection drug use (e.g., infection at an injection site, abscess from long-term shooting), especially among younger individuals. All of these providers also provided a link between homelessness and acute skin conditions. For instance, the homeless encampment in Camden is overgrown and can only be accessed through rougher terrain. For this reason and others, homeless individuals get a lot of cuts and scratches which, because of poor hygiene and environment, get infected. One provider gave an anecdotal account of a homeless man whose cut had gotten so infected he was facing an amputation as a result. Also because of life on the street, people may experience bug bites, rashes, and so on. Susan a public health nurse stated the following about her clients, most of whom are homeless:

“Oh I see a ton of skin, like scabies, all the time, bed bugs, bites, it’s constant. (...) like just exposure, hypothermia, like I see a lot of that too. Or with mental health conditions, they’ll cut or they’ll pick and stuff like that, get infections so, you’ll see that a lot.”

In addition, Sam said people with poorly managed diabetes often develop skin ulcers which could be assigned a code for skin and/or wounds at the ED. If their diabetes was poorly managed because of lack of access to or interest in seeing a primary care provider, it could explain why people may not seek help for ulcers until they reach an acute level. Bob, the community health worker that links jail inmates to services upon release, also said that itchy skin is a common complaint he hears from men immediately after leaving jail. He was unable to link this to a reason or specific diagnosis; but he did say referring a client to health services for a skin-related issue was a regular occurrence.

Dental concerns were another health issue that increased in prevalence as number of system contacts increased. Mary said there could be some injuries grouped into dental as well, like teeth being punched out or a broken jaw. Otherwise, all providers that mentioned dental (n=4) agreed it was related to lack of access to primary care. Sam the EMS manager stated they are called a lot for tooth pain and:

“It’s lack of access. They’re not getting any primary dental care, so they wait until the root’s exposed and they’re in agony and they call us.”

An interesting caveat, however, is this is likely not the result of people being without a way in which to get dental care as Medicaid and Medicare cover dental, and a local program in Camden provides free dental services for low-income individuals. Instead, it seems this is a function of people choosing to not access preventative dental services like cleanings, and instead waiting until issues reach an acute level. This could be because, as one provider suggested, sometimes relatively simple tasks like making appointments cause stress and anxiety so are avoided. Another stated it could be because dental issues are addressed in a place separate from medical needs, so require an extra step that many do not take. Similarly, the same provider (Susan) said she finds normal

attention to dental is just not a priority or people are completely unaware: “Some don’t even know what a dentist is.” For this provider in particular, and confirmed by others, visiting the ED for multiple dental-related concerns could be addressed through more health education around preventative care and where it can be accessed.

Resistance to treatment and/or lack of access relates to chronic conditions as well. Many cross-system involved individuals visited the ED for chronic conditions like asthma, COPD, hypertension, hepatitis or chronic kidney disease – which did not surprise the medical professionals interviewed (i.e., Sam, Mary and Susan). As a group, they explained this as people who cannot (i.e., access) or do not (i.e., resistance) keep up with their health obligations after being diagnosed with something chronic. When these serious conditions are left untreated for too long, they can obviously lead to acute issues. According to providers, people in certain socioeconomic classes especially the homeless may visit the ED to fill prescriptions or obtain medicine they’ve lost.

Abdominal pain is an extremely common reason for ED contact in general (Weiss et al., 2014). Significantly more individuals in the most problematic joint trajectory groups visited the ED for abdominal pain than the more sporadic cross-system involved groups. Mary (ED physician) brought up abdominal pain on her own to comment on how this diagnosis category groups many different kinds of people/issues together. For one, it could be abdominal pain linked to a more serious condition. In those cases, it would be followed by an inpatient admission or testing. For the majority of individuals who present with abdominal pain however, especially multiple times, she finds it is usually a somatic reaction to stress and anxiety. Under prolonged stress, some people develop stomach pain, diarrhea or nausea/vomiting that they may be unaware links back to their mental

health and level of distress. In some cases, abdominal pain could therefore be seen as a proxy for un- or under-treated mental health. Mary was the only provider to mention this.

### ***Comorbidity & Multimorbidity***

More so than just co-occurring mental illness and substance abuse, the comorbidity of multiple issues was something suggested by multiple providers as a distinct driver of frequent cross-system involvement. With Bob, who oversees a caseload of frequent cyclers, I talked about the many factors at play – mental illness, drugs and alcohol, homelessness, poverty, social support, and so on – after which he stated:

“Provider: It’s just like, when you put all of these in one bucket you got somebody who’s homelessness, has poor access to healthcare, maybe they have a criminal history, substance abuse issues, and mental health, a history if incarceration...you put all this stuff into one bucket, those are the kind of people that I work with.

Interviewer: So it’s probably not a matter of one thing that sticks out, or 2 things that stick out. It’s more the extent of everything together?

Provider: Yea because I can think of people right off hand that I worked with – just about almost everything on that list would be a check box.”

In a similar vein, Mary said she thinks about risk for frequent cycling in terms of not just which diagnoses people have, but how many.

“I think it comes back to like how many of these they have, if you’re going to like risk stratify them, right, the people who are like substance use alone versus substance use plus chronic medical conditions plus mental health issues, you know?”

After reviewing the joint trajectory groups, Anna the jail administrator pointed out how comorbid issues influence each other to encourage cross-system involvement.

“The one thing that this kind of makes me think of – all of these factors, like the physical health, if you aren’t in good physical health, you probably are less likely to care or even to be mindful or aware of your mental health needs. And then because of your physical health, you might be using drugs to help you feel better physically. (...) So it’s, they’re the least stable – individuals that have all 3 are the least stable. Even if they aren’t homeless, they still aren’t stable.”

The quantitative data show that, for members of this sample, comorbidity does increase in prevalence with more cross-system contacts. From the provider interviews we learn that comorbidity is important to consider, not just because more issues exist, but because they interact with each other to make the issue larger than the sum of its parts.

### *Homelessness*

While I do not have corroborating data on housing status, every provider mentioned the role of homelessness and housing instability in frequent cross-system cycling. This warrants extensive future study. We know on the criminal justice side that homelessness is associated with arrest and incarceration – in general and repeatedly – and that police encounter homeless people at an elevated rate (Greenberg & Rosenheck, 2008). What providers emphasized was the toll homelessness takes on one’s health and odds of frequent involvement with the ED. Medical professionals, including Mary the ED physician, often cite homelessness as a leading cause of frequent ED contact. When I asked Mary if homeless people use the ED a lot because of actual health needs or health emergencies; or as a warm place to sit, for instance, she answered the following:

“Yea, it’s certainly shelter-related and that has to do with, like, the season plays a role there, but also just for like chronic health issues that otherwise, you know, patients with like COPD or asthma that need daily treatments or diabetes that don’t have a fridge to put insulin in so they’re having, like, recurrent exacerbations of that, of their underlying chronic illnesses because the lack of, you know, the continued, their ability to care for themselves, having a place to do that, you know, like, medications is really tricky in the shelter system.”

As mentioned above, homeless people have a much harder time maintaining their health. Providers stated that they get acute infections more easily, have trouble maintaining continuity of care for serious conditions, are often victimized and injured, experience mental health symptomology and addiction in public, get robbed or otherwise lose their

belongings including their medications, may experience bias from police and ED staff because they are known to be homeless, and so on. Susan a nurse said that a lot of ED contact could be avoided if people were not living on the street: “I mean a lot of them are drunk, high, getting beat up, or the mental health and they’re falling a lot. But yea, I mean it’s because they’re on the street.”

Regardless of what issues caused a person to become homeless in the first place, the experience of living on the street tends to make everything worse. Tara explained this snowball effect of homelessness in the following way:

“And that’s the conversation we have with people, like, once you’re homeless (...) for a while, you become homeless longer. (...) you become more depressed, more physically ill, more addicted, you know. It just becomes worse and worse and worse. (...) And they get it. They know that this is a horrible, traumatic life.”

These discussions tell us that homelessness and housing instability have a significant impact on all aspects of a person’s life, including one’s likelihood of frequent cross-system cycling. Health and social needs compound and become more significant, priorities shift to daily survival, depression and substance abuse increases, and issues overall get more difficult for providers *and* individuals to address.

### ***Violence***

Other than substance abuse and homelessness, Mary said interpersonal violence is the primary driver of frequent ED use and overlap with police. This could include anything from domestic violence, to accidents, gunshot wounds, and altercations. In addition, every provider that discussed homelessness also mentioned the tendency of unhoused people to get injured and victimized.

I asked Sam if we could rule out mental illness, substance abuse and homelessness – what frequent cyclers would remain? He answered that the rest could be

attributed to violence. He offered the example of people who sell drugs and are also injured in fights and shootings; and those who ride illegal ATVs through Camden and get injured. He also said that people could be victimized by violence, thus engage with both police and the ED. He also stated the following:

“Interviewer: Could that be part of what causes people to touch both systems? Like violence in general.

Provider: Oh yea, absolutely. Yea. We’ll have, you know, domestic where it’s boyfriend on girlfriend, husband on wife, those type of things where they, you know, and the other issue here in the city is – you have it listed there, 3% prostitution – there’s a fairly high, active prostitution trade in this city. So if the girls get beat up, they may wind up in the hospital. If they get an STD, they might end up in the hospital. They may get arrested for being out on Broadway.”

Many more members of the frequent joint groups were arrested for prostitution. I asked providers to weigh in on the role of prostitution; and four had personal experience with sex workers in the community, including the EMS manager. For one, each said substance abuse was experienced by nearly every single one with whom they worked. They also commented on the many injuries and health-related issues these individuals tend to experience.

Being exposed to violence, as a perpetrator or victim or both, seems closely linked to frequent cross-system for some people. In particular, violence and prostitution could explain cycling among younger people and/or those without serious health issues (i.e., mental illness, chronic conditions).

### **Role of Age in Frequent Cross-System Involvement**

While all service providers mentioned the role of age, it was discussed in varying contexts and to different degrees across interviews. This section is therefore a compilation of points made by participants in reference to this research question. First, in confirmation of quantitative findings, Mary (ED physician) stated that STIs are a

common reason for young people to visit the ED. She said this is likely because STIs feel urgent and can cause fear or anxiety, so young people in certain communities use the ED to get immediate answers as they may have to wait a while to see their PCP.

Moving to larger themes, most of the discussion of age revolved around the typical age range of individuals who contact both systems. Providers tended to agree that frequent cycling is not something older people do. According to the three providers that brought up this point, younger individuals seem to have more energy to engage in behavior that results in police and ED contacts. For one, Sam (EMS) stated:

“I think, to answer your first question, most of them are in that younger crowd. Just because they have the youth. If they stay with it, if it doesn’t kill them, then they, you know, just like everybody else, they tend to slow down with age and, I guess, with maturity too. Some of them don’t want to be on that treadmill or that revolving door where, you know, I’m in the emergency room, I’m in jail, you know.”

On the other hand, providers also pointed out that younger people often have access to resources that prevent the worst forms of cross-system cycling. These supports include family, friends, employment, their physical health, and the like – things older adults, especially those with mental health and substance abuse issues, no longer have.

Bob with a client list of frequent users stated the following:

“So if you have substance abuse issues and mental health issues, I’m just saying that’s like a “cocktail” for burning relationships.”

“...our big population of the most people we see are the 40 to 50-year old men. That’s our group. At that point, they’ve burned their bridges. The young people, they have bridges left, you know? They still have options. It’s the older people that have had the addiction for 20 or 30 years that have burned all their bridges.”

Confirming the quantitative results, this suggests that frequent cross-system involvement is experienced by mostly middle-aged adults (i.e., 30s, 40s, 50s). Providers stated that older adults (i.e., those at the tail end of their cycling) are often more open to

discussing health and otherwise pursuing treatment – and also exhausted by a lifestyle that includes repeat system contacts. When people are ready to change, or open to accessing help, they should be afforded that opportunity at the point of a system contact. In the opinion of Susan a public health nurse, ED contact for people there repeatedly could be a “cry for help” that our systems are simply too over-burdened to respond to.

### **Service Provider Recommendations**

Providers suggested a range of important service approaches, both existing and hypothetical, to address frequent cross-system involvement. First, Mary the ED physician mentioned an existing program at a local hospital that works with just five individuals who were identified as daily users of the emergency room. She said the program is not official but sprang up out of the need to address the multi-dimensional needs of these people in order to reduce their frequent ED use. Services for this very small, “super-specialized” group of people is holistic in nature and attends to their needs across domains, not just medical. She suggested that this approach could be helpful for people that make much less frequent contact with the ED, but still visit too often – like monthly, she offered. She was not the only person to mention the value of holistic approaches in order to address the multiple needs frequent cyclers present with, from social to behavioral to medical. Once at the level of frequent cycling, the interplay between factors is much stronger and may require more individualized care.

While understandable given her area of expertise, the program manager of a homeless shelter suggested that coordinating homelessness services across Camden County would reduce cross-system involvement for many individuals. This would mean having one number for people to call to access all services instead of calling around each

day for a bed. This would also mean making services quicker and easier to obtain; and collaborating across domains to make sure the community can address the needs of everyone that reaches out for help. She provided a poignant quote about the experiences of individuals caught in Camden's fragmented system and the difficulties they face trying to stabilize their lives:

“But I saw very clearly that the system was broken and I describe what we do here as a system in South Jersey as treat people like a ping pong ball, and at the end of the day people are stepped on and crushed and that ball is crushed and that is what we do to people. We discharge from ERs and hospitals to shelter, can't sleep on a cot when you're trying to convalesce. We tell people go from here to here to here to here to literally ping around, and by foot with stuff in their hands and, you know, if you know homeless people you know that whatever their biological age is, add 20 to it because they're beat up. (...) Broken, broken, broken!”

Susan mentioned that, to her knowledge, social workers and other forms of support do not kick in at the hospital unless a person is admitted. In other words, there are no hospital employees in the waiting room at the ED checking on the needs of people that will never be seen or admitted – despite this being a particularly vulnerable group of individuals (i.e., the homeless). This means even services that could be extremely helpful are not made available to people that access the ED often but are never admitted to either the ED or the hospital. This was confirmed with a quote from Mary, an ED physician:

“I would love if there were better resources to offer people upon discharge, because a lot of these, like most of these complaints that you're seeing with the exception of maybe the chronic ones – the asthmatics and diabetics that have to be admitted – like nearly all of these that you showed are people that we're discharging. They're not getting admitted.”

In addition to adding social workers to other points of contact at the hospital, Susan (public health nurse) suggested embedding them into police departments in order to better deal with issues that do not rise to the level of a formal arrest. This would allow trained professionals to connect people to services upstream from arrest and ED visits.

This relates in many ways to a common theme across interviews. When asked for service approaches for this population, multiple providers lamented the lack of discharge planning for individuals leaving either system. Instead of seeing a system contact as an opportunity for intervention, it seems common for individuals to be released back to their circumstances, or “streeted”, directly from jail, the “drunk tank”, the hospital and the ED. These individuals are not given a plan, or offered any assistance, at the time of release and are instead sent back into the community to cycle further. When talking about the 46 individuals in the high arrest/high ED joint group, Anna said:

“And I speculate that the majority of them were probably, they’re just walking outside of the ER and they’re going back into Camden City. And, you know, we see people all the time walking around with their bracelets on and you can tell they have the clear bag with their belongings. If people who are presenting with serious, chronic issues, we shouldn’t be releasing them.”

Further making this point, she went on to say:

“And often when you’re arrested, especially during this time period so I’m trying to keep that in context, if you present with mental health or you present with substance abuse issues and you don’t go to the jail, or you do go to the jail and you’re out, there’s no sort of, nobody jumping in to help you.”

The additional oversight of a probation or parole officer was considered an asset when trying to help a difficult client by Bob the community health worker and Susan the public health nurse – but POs are only assigned to certain justice-involved people. Those who are arrested often but for extremely minor offenses, or who “maxed out” of prison and released without supervision, are also often health-vulnerable and in need of services. Similarly, there is no equivalent upon release from the ED. While hospital social workers may connect people to physical therapy or social services in an extreme case, they are focused on an individual’s medical aftercare and only assigned, again, to some individuals. Highlighting a shortcoming of the current system, Susan said the following:

“So in the hospitals, I hate to say it, some of the staff they’re just like, “oh they’re just gonna be back here tomorrow night.” And it’s like, alright, well obviously there’s an issue so why aren’t you guys doing more for them? Why aren’t you consulting with psych? Why aren’t you calling their families or agencies? It’s because that’s not their job. It’s not an acute issue.”

She recommended hiring people like probation officers or “parents” for frequent ED users – even those that are never admitted – to follow them into the community post-and make sure they maintain their health and avoid police contact.

Next, the criminal justice professional stated that since the justice system interacts with many mentally ill and substance abusing individuals, they (we) should be doing more at the time of a person’s first arrest to address their needs and provide support. This would prevent the emergence of issues that tend to get worse once formally involved with the justice system. While stopping short of giving justice system involvement a causal role in worsening health, she stated the following:

“So if there’s a situational circumstance that contributed to you getting arrested, you’re just released and then you go to court and, you know, particularly for our younger population when they first, initial occurrences and with the courts, people say once you have that initial interaction, your trajectory for successful reintegration, for remaining arrest-free and incarceration-free, isn’t that high. I mean, because we don’t as a system do anything to help provide support. (...) I think being more supportive after the initial arrest (...) if the arrest is because of a mental health or substance abuse situation, addressing that. Not locking people up or using the criminal justice system as a way to help ameliorate that situation. So we respond to the crime but not actually the person. [Then] I mean like anxiety, depression, it takes a toll on you. It’s not a super positive experience.”

Lastly, Bob extended a simple but important recommendation. In his work he finds that until a person secures housing and addresses their physical and mental health, nothing else meaningful can be accomplished. It is unreasonable to expect behavior change among people who have need in these areas.

## CHAPTER 6: DISCUSSION

In the discussion that follows I will pull out key quantitative findings and, when possible, supplement them with insights from the provider interviews. Because the overarching purpose (thus the focus) of this dissertation was on generating a more detailed picture of frequent cross-system involvement by bringing together arrest and ED trajectories, I will concentrate mostly on findings around the joint groups representing frequent cycling between these two systems.

Before turning to that main topic, I will briefly point out important findings from the analyses done to answer RQ1 through RQ4 which laid the foundation for understanding factors associated with frequent cyclist groups. These research questions looked at health disparities of arrestees in general, the health profiles of the arrest and ED trajectories taken separately, and the overall relationship between arrest and ED group membership. Research questions 5 through 10 were posed to better understand the major themes of this dissertation: frequent cross-system involvement and health-related strain. These research questions will therefore be addressed at the end of this section in the context of these overarching themes. I will then turn to limitations faced by this study followed my implications for research, practice and policy.

### **Key Findings from Research Questions 1 through 4**

#### *The Health of Arrestees*

When looking at a general sample of arrestees that visited the ED between 2010 and 2014 compared to their non-arrested peers, results showed that a significantly higher proportion of justice-involved adults visited the ED for all of the diagnoses examined – everything from abdominal pain, chronic conditions, dental issues, skin conditions and

injuries, to mental illness, substance abuse, co- and multi-morbidity. More arrestees than non-arrestees also visited the ED multiple times (3 or more) to address dental issues, injuries, skin conditions, mental illness and substance abuse. The largest between-group differences were in mental illness, substance abuse, skin conditions, injuries, wounds, multiple injuries, dental issues, and co-occurring mental illness and substance abuse.

It is well known that, as a group, justice-involved individuals experience more health-related issues – but most of the extant research in this area focuses on incarcerated samples (Binswanger et al., 2007; 2009; 2012); and few have pulled out specific health conditions that impact offenders at a higher rate (McConville et al., 2018). These descriptive findings are a meaningful contribution to criminological research in general because they speak to the substantial and diverse health burden of the individuals with whom the justice system interacts in the community. In addition, even younger adult arrestees in this sample between 18 and 22 years of age visited the ED at a higher rate than their non-arrested peers for many of the same health conditions as the full sample (e.g., chronic conditions, injuries, dental and skin issues, STIs, mental illness, substance, comorbidity). The factors or mechanisms that lead poor health and justice system involvement to overlap are therefore present even early in life and are not necessarily a function of age. It is essential that officials and researchers going forward recognize the significant health needs of members of the criminal justice population. This definition of poor health extends further than mental illness and drug/alcohol abuse to also include acute and long-term physical conditions and frequent health emergencies.

### *Health and Accumulating CJ Involvement*

Group-based trajectory modeling (GBTM) was performed with the full adult sample of arrestees to uncover patterns of justice system involvement with a focus on different forms of “frequent” or persistent arrest. My final solution produced six different patterns, two of which represented “frequent” contact with the justice system [G12 & G13]. Together, the top two groups (increasing and high) represented 4.5% of the total arrest sample (n=1,191), which is very consistent with other research that finds roughly 5% of offenders and ED users are responsible for the majority of arrests/hospital contacts and considered “frequent flyers” (Constantine et al., 2011; Milgram et al., 2018).

In addition to comparing the health of frequent to non-frequent arrestees, I conceptualized different patterns as different levels of justice system involvement. This study is among the few to look at the association between health and crime using a measure of justice system involvement that captures an increase over time (i.e., not binary like yes/no on probation, yes/no a “high” user) – something Lorvick and colleagues (2018) referred to as “CJ accumulation”. Consistent with prior research (Lorvick et al., 2018; Wang et al., 2013), I found that substance abuse, bipolar disorder, poisoning/overdose and skin conditions each increased one’s odds of “CJ accumulation”. Chronic conditions, injuries, dental issues, wounds, anxiety, depression, schizophrenia, suicide, and comorbidity also increased significantly and in a linear fashion along with rate of arrest for members of my sample. While many of these issues are tied empirically to offending in general, their association with an escalation in or higher rates of justice system contact over time is less clear. In general, my findings implicate a relationship between a range of health-related issues (or overall poor health) and an increase in

offending over time. Multiple justice system contacts should be given more weight as an important risk factor for worse health and ED/public health system contact.

### ***ED Contact for Skin Conditions***

ED visits for skin conditions like abscesses and rashes increased in prevalence along with level of arrest, ED contact and (bringing these systems together) cross-system involvement. Visiting the ED for a skin condition also predicted frequent arrest for adults in this sample. These findings were not anticipated ahead of time necessarily as skin issues are not intuitively nor empirically linked to offending except, to my knowledge, in one other study (Wang et al., 2013). The qualitative providers interviewed for this study were familiar with skin issues, however, and stated that visiting the ED at all, but especially more than once, for this reason is likely indicative of larger issues like poorly controlled diabetes, long-term injection drug use, skin “picking” due to mental health symptomology or addiction, and homelessness (i.e., experience frequent cuts, scrapes, bug bites, infections, etc.). A provider that works regularly with ex-inmates cited general skin issues like itching or rashes as a common complaint immediately post-release; and Susan, a public health nurse that works with people in poverty including the homeless, said skin issues like scabies, bug bites, exposure and rashes were “constant” and something she encounters “all the time”. After discussion with providers and corroborated by Wang and colleagues (2013), I would argue that multiple ED contacts for this diagnosis should serve as a proxy for serious underlying issues that cross domains like homelessness, unmanaged chronic physical health conditions, substance abuse, serious mental illness and higher rates of arrest by police. Flagging a condition is only useful when we have resources to refer flagged individuals to; but people who visit the

ED for skin-related complaints should be visited by a social worker at the very least to understand his or her underlying needs. This diagnosis should also be incorporated into subsequent research on health and criminal justice in order to learn more about the relationship between skin conditions and offending.

### ***The Relationship between Arrest and ED Contact***

I found overwhelming support for a relationship between arrest and contact with the ED (Frank et al., 2014). For one, as arrests accumulated, ED contact became almost inevitable for adults in this sample with 96% of the highest arrest trajectory [G6] and 92% of the increasing arrest group [G2] making at least one ED contact compared to 55% of the trajectory with the fewest arrests [G3]. The same pattern was observed for young adults (more arrests, higher prevalence of ED contact). A table included as Appendix F showed that as number of arrests increased at the individual (not group) level, so did the proportion that visited the ED at least once; and beginning at 24 arrests, this proportion plateaued at 100%. In other words, everyone in my data with 24 or more arrests during the study period had visited the ED at least once during that time. My findings are consistent with work by Frank and colleagues (2014) who found a strong relationship between arrest and past year ED involvement with arrestees making significantly more ED visits than their non-justice involved peers. Also consistent with prior research, members of higher arrest trajectories were more likely to visit the ED multiple times; and an increase in ED contacts predicted frequent arrest (Constantine et al., 2010).

Using a nationally representative sample, Frank and colleagues (2014) found 47% of arrestees reported past-year ED visits compared to 27% of the control group. While lower than rates found in this study (62% of the total arrest sample visited the ED), they

are similar enough to argue for generalizability – that the majority of arrest samples regardless of location visit the ED. This may also tell us that adults who contact these systems in Camden, NJ experience more arrest/ED overlap than the U.S. overall.

As hypothesized, I found that members of the “frequent” arrest trajectories (increasing [G2] and high [G6]) were significantly more likely to also belong to “frequent” ED trajectories (mid and high) than was expected by chance. In fact, the majority of either frequent arrest group (i.e., 52% of G2, 70% of G6) were members of a frequent ED group [G9 or G10]. Not only did one’s risk of any ED contact increase with number of arrests; but so too did one’s chances of *repeat* ED involvement. This echoes a report by Haynes and Dion (2012) that suggested frequent use of one public system like criminal justice or public hospitals/EMS was associated with frequent use of other public systems during the same period of time. Once system involvement develops toward frequent, needs compound to engender contact with other public systems. System use therefore begets more, and more forms of, system involvement. We should therefore be invested in stopping cross-system contact as soon as it develops given the strong likelihood of sporadic contact to progress into multi-system cycling. We should also henceforth assume that adults with a high number of arrests are very likely to have health needs and to utilize the ED to address them, often at a high rate. In sum, this means the justice system and the ED should not be conceptualized nor operate as separate institutions in isolation as the most high-need and health-vulnerable people in either system are part of a shared population.

## **Frequent Cross-System Involvement**

Again, the main goal of this study was to thoroughly examine a sample of frequent cross-system cyclers using descriptive and predictive methods and supported with qualitative interviews with providers. These findings culminated to produce a robust description of the issues experienced by this population in Camden between 2010 and 2014. In this section, I will integrate quantitative and qualitative findings to describe the most salient physical and mental health needs of frequent cyclers and what factors increased in a linear fashion with level of cross-system involvement – thus what could be targeted to prevent and reduce system contact.

The frequent cross-system involved population in Camden has been described elsewhere by researchers at The Coalition (Milgram et al., 2018; Green et al., 2010). This dissertation builds upon these reports by comparing specific health issues across different patterns or “levels” of single- and cross-system involvement to see what issues emerge or get worse as system contacts accumulate. This treats sporadic and frequent cross-system involved groups as distinct in terms of their healthcare needs. I used predictive methods to examine what issues directly impact one’s odds of frequent cycling over low-rate involvement with arrest and the ED. I also derived my “frequent user” groups with a different methodology (i.e., used GBTM instead of the top 5<sup>th</sup> percentile over 5 years).

As displayed in Table 7, individuals in the two highest arrest and ED use trajectories were brought together to determine the four most “frequent” joint trajectory groups (and the lowest joint trajectory for comparison). Select joint groups in this table were perceived as different “levels” of cross-system involvement with low arrest/low ED representing “low” [G11], increasing arrest/mid ED “mid” [G15], and high arrest/high

ED “high” [G12]. Using this convention, a range of health- and justice-related issues increased in a linear fashion with “level” of cross-system contact. Models were also run to predict “frequent cross-system involvement” (over sporadic cross-system contact) which was measured in these models as membership in either the high arrest/high ED or the increasing arrest/high ED joint groups [G12 + G13]. Overall, I found that knowing someone is cross-system involved does not tell the whole story. Like with arrest, the extent to which a person has contacted either/both systems has important implications for health. Namely, as cross-system contact increases in frequency, health issues become more complex and significant thus more difficult to address. This means it is never too early to intervene. Turning to specific diagnoses, we can learn what to target.

Before moving on, however, it is important to note that being black translated into elevated odds of frequent cycling for members of this sample. While future research should dig deeper into this relationship, being black in this context could represent concentrated and significant disadvantage and long-term lack of access to health services. Criminal justice scholars are already aware that racial minorities are more likely to be arrested; but the fact that I found these individuals are also more likely to frequently visit the ED may mean they have fewer opportunities, at least in Camden, to receive primary care services and otherwise address health issues in places other than the ED. Structural and concentrated disadvantage and its relationship to race must be explored further in future studies to understand this topic.

### ***Mental Health & Substance Abuse***

The largest differences between levels of cross-system involvement were related to mental illness and substance abuse, which consistently increased across joint groups

(low to mid to high). The providers interviewed echoed this sentiment. Sam (EMS) for instance said “...even before you showed me any of the data, I would have said that the leading cross-over between the 2 groups is mental health and substance abuse.” These indicators also increased significantly across levels of arrest and ED use when considered separately – implicating both in higher rates of single- and cross-system contact. While the body of work on frequent system involvement is relatively small, nearly every study that sampled “frequent fliers” of justice and public health remarked on the disproportionate rates of mental illness and drug/alcohol abuse for members of this population (Constantine et al., 2010; Ford, 2005; Green et al., 2010; Harding & Roman, 2018; Kushel et al., 2002; Lorvick et al., 2018; MacDonald et al., 2015).

In terms of substance abuse for the current sample, 91.3% of the high/high joint group [G12] visited the ED at least once for drugs or alcohol, 84.8% multiple times, with a group mean of 14 ED contacts for this reason in five years. While 13.5% of the low/low group [G11] experienced substance abuse, virtually no one at that “level” made multiple ED contacts for that reason (1%) and only one-quarter of the “mid” level group [G15] did so. The jump from low to mid to high was therefore a precipitous one; and nearly every single member of the highest joint group [G12] visited the ED for this reason. Another interesting comparison – across members of the high ED trajectory [G10] as a whole (regardless of arrest history), only 30.5% visited for substance abuse. Members of this group that were also frequently arrested were therefore much more likely to visit the ED for drugs or alcohol than those without justice system involvement. Lastly, regression models showed that each additional ED visit for drug/alcohol abuse significantly increased a cross-system involved adult’s likelihood of frequent cycling.

These data show that active addiction, both alone and co-morbid with mental illness, drives a large amount of frequent cross-system cycling; and applies to systems in Camden and in general. This is the case for obvious reasons like the significant toll drug abuse takes on one's body physically and mentally, its ability to thrust people into poverty and damage personal relationships, its impact on daily functioning and on one's priorities, the fact that most abused substances are illegal and require engagement with other offenders, and so on. Drug abuse is a predominant issue in Camden in particular, with overdoses constituting more than 20% of the EMS department's calls for service. My findings reiterate those from countless other studies that argue for better, more comprehensive substance abuse treatment for those who need it most and in the places most affected. Relying on the ED and the justice system to treat issues arising from long-term alcohol and drug abuse is short-sited, ineffective and inefficient.

Regarding mental illness, my results do not suggest that serious issues like psychotic disorders or bipolar had a direct impact of frequent cross-system involvement (as hypothesized); but I did find a relationship between bipolar disorder and frequent arrest. Prevalence of both diagnosis categories (i.e., schizophrenia and bipolar) also increased along with level of cross-system involvement and were significant for all between-group comparisons. While future research is needed to determine what patterns of frequent cycling can be attributed directly to mental illness, if any, my findings suggest that serious mental health issues like bipolar and schizophrenia may be associated with more justice system involvement (Harding & Roman, 2017) but do not drive people as strongly into the ED.

ED contact for depression did, however, predict frequent cycling. Rates of ED visits for anxiety, depression and suicide increased precipitously across levels of cross-system involvement; as well as across levels of arrest and ED contact when examined separately. Total adult life expectancy in the U.S. has declined in recent years. In other words, U.S. adults as a whole are living shorter lives than adults only ten years ago. This is an unprecedented and unexpected effect largely attributed to a rise in “deaths of despair” (Case & Deaton, 2015; 2017). These include premature deaths from suicide, drug overdoses, long-term drug addiction, chronic stress, and similar issues associated with hopelessness, a lack of resources and community disadvantage (Shanahan et al., 2019). Between 2006 and 2013, rates of ED visits for depression, anxiety and substance abuse climbed significantly among adults in the U.S. with the largest increase seen for people living in lower-income communities (Weiss et al., 2016). Looking to this sample, frequent cycling was associated with uniquely high rates of diseases of “despair” – perhaps as a consequence of such persistent and long-term cross-system churning.

To make this point further, very few members of the low/low joint trajectory [G11] visited the ED for anxiety, depression or suicide (less than 3%). Slightly more members of the “mid” level group [G15] contacted the ED for these issues (7-15%); but these proportions jumped precipitously from mid to high with more than half (52.2%) of the high/high joint group [G12] visiting for anxiety, 47.8% for depression, and 32.6% for suicide. This is in contrast to the more linear progression in prevalence from low to mid to high seen for most other diagnoses. Additionally, regression models showed that each additional ED visit for depression significantly increased a cross-system involved person’s odds of frequently cycling (i.e., membership in G12 and G13). According to

Mary, mental illness and suicide are difficult to diagnose at the ED so this is likely an underestimation of these issues for this population.

The providers implied that issues like depression and anxiety both arise and are exacerbated by experiences like justice system contact and poor health in other areas. In the words of Bob the community health worker, as cross-system involvement persists “...their anxiety and stuff gets super bad and they get depressed and it’s a snowball effect.” I would argue that anxiety, depression and suicide accumulate along with cross-system contacts as a result of the damaging effects of arrest and poor health – consequences of the instability and hopelessness associated with frequent cycling. I would further argue that regardless of what issues thrust an individual into a cycle of cross-system involvement (i.e., violence, homelessness, poverty, active addiction), the experience of frequent arrest and acute health issues engenders more of these “diseases of despair”. On one hand, that means these issues may be largely preventable for members of this population with services to address needs that encourage cross-system cycling in the first place. But this also implies that by not intervening early enough, we allow for hopelessness and desperation which have their own ramifications for health and behavior.

### ***Chronic Physical Health Conditions***

Turning to physical health, 71.7% of the high/high group visited the ED for a chronic condition like asthma, diabetes, hypertension or HIV, with 45.7% making multiple ED visits for a chronic physical health issue in five years. The presence of any chronic condition increased a cross-system involved adult’s odds of frequent cycling by more than 14 times. This was not only an issue for older people as even members of 18-year-old subsample had ED contact for chronic health conditions – namely 21.6% of the

increasing young adult arrest trajectory. Young adult arrestees also visited the ED at a higher rate than their non-arrested peers for chronic health conditions despite being only 18 to 22 during the study period. This disparity is therefore established early in life. A table included as Appendix G breaks the ‘chronic condition’ variable into its individual diagnoses for each of the 22 different trajectory groups (i.e., full sample arrest and ED, joint groups, young adult subsample arrest and ED).

Chronic health conditions have been linked in prior research to justice system involvement (Binswanger et al., 2009; Verdier et al., 2018) and frequent arrest/incarceration (Houston Police Department, 2010; MacDonald et al., 2015). Unmanaged chronic conditions can also drive frequent ED contact, especially among older adults and the homeless (Billings & Raven, 2013; Kushel et al., 2002; Ondler et al., 2014). The relationship between chronic physical health issues and frequent cycling is therefore not surprising (Milgram et al., 2018).

Taking a step back, these findings call attention to the link between chronic health conditions and justice system involvement. The relationship between poor physical health and justice system involvement is complex and will be discussed in more detail later in the context of General Strain Theory (Agnew, 1992). When asked about the link between chronic physical health and cross-system involvement, particularly arrest, the providers largely attributed this overlap to poverty and homelessness – conditions which serve as barriers to long-term treatment *and* can encourage justice system involvement. They stated that multiple ED visits for chronic health conditions likely means poor access to treatment and an inability or unwillingness to adhere to a long-term treatment plan, which lead to acute exacerbations.

Providers also mentioned that people without stable housing use the ED for non-acute reasons like to replace prescriptions that were stolen or lost. For instance, Mary mentioned that homeless people often have trouble keeping insulin cold when they are living in a shelter; or get medications or clean needles stolen from them on the street. And while I did not have data on insurance status, many providers stated that even people with Medicaid and Medicare are unaware what doctors to go to for primary care, do not trust the healthcare system so avoid it, or experience long wait times or high co-pays for important services like mental health counseling. Again, the reason the justice system interacts with so many individuals experiencing chronic health conditions is complex and warrants further study. Poor physical health could be linked to offending through poverty and/or could speak to the destabilizing effect on health of justice system involvement itself. The justice system must recognize the ways in which criminal records and incarceration lead to worse health outcomes.

### ***Injuries & Violence***

More than 95% of those in the high/high group [G12] visited the ED for an injury like a broken or fractured bone; and nearly 70% made multiple visits for this reason. Nearly half of the low/low group [G11] experienced an injury as well – which makes sense considering the acute nature of an injury and the purpose of the ED. What is more important is the fact that as cross-system involvement increased, people experienced significantly *more* injuries. The high/high group [G12] had a mean of 7 ED visits over five years for this reason, compared to 1 for “low” [G11] and 2.5 for “mid” [G15]. Another surprising finding – there was a significant jump in proportion of people across

levels of cross-system involvement who experienced a skull-related injury or contusion from 1.5% of the low/low group to 32.6% of high/high.

Frequent cyclers could get injured at a higher rate for a number of reasons. Research has found that offenders are more likely to experience a traumatic brain injury (TBI), to have multiple incidents of TBI, to report more significant psychological issues as a result, and to have been injured through an assault (Perkes et al., 2011; Williams et al., 2018). Perhaps because of its impact on mental health, mood, memory, and overall functioning, experiencing a TBI is also associated with increased risk of violence, more convictions and incarcerations, and a general increase in justice system contact (Farrer & Hedges, 2011; Williams et al., 2018). Many of the qualitative providers mentioned that homeless people are often injured in fights, assaults or falls; and homelessness and poverty are both associated with higher rates of violent victimization (Harrell et al., 2014). We know from prior research that homelessness and poverty are strongly tied to frequent arrest/incarceration (Constantine et al., 2010; Ford, 2005; Lorvick et al., 2018; MacDonald et al., 2015) *and* repeat use of the ED (Kushel et al., 2002). As people remain homeless or impoverished longer, these forms of injury can happen more often.

Another source of injuries could be related to violent crime. Mary the ED physician cited interpersonal violence including street assaults and domestic abuse as a main driver of frequent ED use at her hospital. This was echoed by Sam who mentioned violent altercations, risky behavior (like riding an ATV) and drug sales as reasons for frequent ED contact and the ED/criminal justice overlap, especially among younger people in the community. In terms of violent crime, I found that each additional violent arrest increased one's odds of frequent cycling by nearly 5 times. This is surprising in a

sense because the measure of violent crime used in this study included very serious offenses like murder and sexual assault – crimes for which a person would be incarcerated thus unable to frequently cycle. Unfortunately, I did not have data on incarceration to inform this point. But the measure of violent crime used here also included simple assault, threats of violence and domestic abuse – examples of charges that could be dropped or resolved through probation; and have been implicated in frequent ED contact. Research on the victim/offender overlap tells us that many times perpetrators of crime are also the victims of violence (Ousey et al., 2011). The finding that an increase in violent arrests predicted frequent cycling could refer directly to individuals arrested for things like simple assault (thus not incarcerated) and frequently injured in fights and altercations. In fact, this was the idea behind including violent arrest in the prediction model in the first place. Only a subset of the most frequent joint groups (roughly 20%) was arrested for a violent offense, however; and this was a more prominent issue for younger adults.

An increase in the number of drug arrests was also predictive of frequent cross-system cycling, even after controlling for ED contact for substance abuse. This means participation in the drug trade through either possession or sales/distribution had an impact on frequent cross-system involvement independent of addiction. A much higher proportion of frequent arrestees and frequent cyclers were also arrested for prostitution which is associated with violence, victimization and substance abuse.

Taken together with the findings above, this suggests that as cross-system involvement becomes more frequent, so do incidents of victimization *and* involvement in street crime which could include low-level violence, drug sales and prostitution. Milgram

(2018) similarly found that frequent flyers of Camden’s system experienced disproportionately more injuries and victimization incidents. The needs of individuals who frequently cycle as a result of interpersonal violence or prostitution likely require a different set of services than those who cycle as a result of homelessness or substance abuse – although they may face these issues as well. For one, risk-taking individuals are often younger thus more difficult to engage in services. The consequences of frequent cross-system involvement for these individuals, however, are likely more severe – like death and long-term incarceration. The urgency in addressing the needs of this population is therefore even greater.

### ***Comorbidity & Multimorbidity***

Bringing together physical and mental health, comorbid issues and multimorbidity increased precipitously across levels of arrest, ED use and cross-system involvement. Issues and need across domains therefore seem to compound as system contacts accumulate. For one, 76% of the high/high group visited the ED for mental illness *and* substance abuse compared to only 27.5% of the “mid” level joint group and 4.4% of “low”. Experiencing these issues together increased one’s odds of frequent cycling by more than 5 times. Providers interviewed also emphasized how often these issues co-occur to the extent that it would be “very rare” to find a frequent cyclist that experienced one without the other.

A similar picture emerged for chronic conditions experienced with substance abuse; chronic conditions with mental illness and substance abuse; and multiple (3 or more) chronic physical health conditions which also predicted frequent cycling. That is, rates of these forms of multimorbidity also increased significantly across level of cross-

system involvement. These indicators were even over-represented, although to a much lesser extent, among members of the young adult subsample. The co-occurrence of issues was mentioned by more than one provider during the qualitative interviews. They agreed that when issues like mental illness, substance abuse and chronic physical conditions are experienced together, one's risk for cross-system cycling is extremely elevated. Anna the jail administrator added that individuals dealing with multimorbidity are the "least stable" even if they are housed or insured because of how difficult it becomes for people to prioritize and manage their conditions. Substance abuse impacts a person's mental health, mental illness often means physical health becomes less of a priority, some people might manage their pain or illness with illicit drugs, and so on.

Issues usually co-occur across domains (i.e., discordant multimorbidity) which means distinct forms of treatment may be required to meet a person's needs. This makes multimorbidity challenging to address. For this reason, and because general multimorbidity seems to be on the rise among certain populations like in low-income communities, The Academy of Medical Sciences recently argued that researchers should prioritize this issue going forward (Academy of Medical Sciences, 2018).

Studies have linked multimorbid conditions to justice system involvement (Cuddeback et al., 2010; Mallik-Kane & Visser, 2008) and frequent ED contact (Alhussain et al., 2017). It could be that experiencing multiple conditions prior to contact with either system, especially in the context of poor access to services, drives cross-system frequent cycling. On the other hand, as was argued above, some issues like depression and anxiety may come later as a consequence of negative experiences. For instance, Meyer and colleagues (2012) found a significant relationship between frequent

ED visits and increasing levels of “psychiatric multimorbidity” among recently released prisoners with HIV. This implies an accumulation of different behavioral health issues subsequent to incarceration and a chronic health diagnosis. My findings suggest that needs begin to cross domains and accumulate at a greater rate when cross-system contact becomes frequent.

### **General Strain Theory and Health-Related Strain**

This study is one of many to show that justice system involvement and poor health are closely intertwined. While this tells us about comorbidity, we know far less about causation and the direction of this relationship. General Strain Theory (GST) provides an important mechanism connecting health issues and crime – the experience of stress or strain (Agnew, 1992; Kort-Butler, 2017; Stogner & Gibson, 2011; Stogner et al., 2014). While this dissertation did not undertake a test of theory or causation, these findings do support aspects of GST, particularly the concept of health-related strain (HRS). As outlined in the Literature Review, GST posits that certain stressors can lead to criminal or deviant behavior, either directly or through negative emotions like anger, frustration or depression (Agnew, 1992; 2006). HRS states that poor health and health emergencies work through the same mechanisms outlined in GST to encourage crime (Stogner & Gibson, 2010). Strain can be used to explain not only the initiation of crime, but also persistence in offending over time (Slocum, 2010). In addition, health strain is uniquely situated to explain the predictive relationship between poor *physical* health and arrest found in the current study, which is less clear and less often studied than the link between crime and behavioral health. I used ED contact as a proxy for HRS to examine

the relationship between HRS and persistent offending. Overall, I found strong support for the argument that poor health (thus HRS) has a relationship with repeat arrest.

First, if strain is said to cause crime we would expect the presence of HRS to precede criminal offending in time. Looking to the subsample of 18-year-olds for this answer, it was possible to see if experiencing health-related issues preceded one's first arrest in the adult system. While not a perfect test of GST, I found that members of each young adult arrest trajectory established patterns of ED contact earlier in time than arrest – particularly for the low and increasing groups. Simple counts across the total young adult subsample also showed that hundreds more young adults visited the ED during the first and second six-month periods than were arrested. This echoes a study by Ramaswamy and colleagues (2015) which found that adults in jail had significantly higher rates of ED contact than their non-jailed peers even before their first incarceration.

Second, consistent with prior research, I found that HRS had a direct relationship with persistent offending (Slocum, 2010; Stogner & Gibson, 2010; Stogner et al., 2014). Specifically, visiting the ED increased a young adult's odds of being arrested *more often* by more than six times. As evidenced by the regression models included in Table A12 in Appendix J, controlling for a range of demographics and health-related issues including depression, ED contact was also predictive of frequent arrest for the full adult sample. While I used ED contact as my measure of HRS, ED use for individual diagnoses were also predictive of more arrests including skin conditions, poisoning/overdose, substance abuse and injuries. Health-related strain could have been measured using any of these individual health conditions as well – further making the case for the impact of health issues and emergencies on increasing rates of criminal behavior.

Next, there are temporal dimensions of strain that have received less empirical attention than GST overall (Slocum, 2010). For instance, multiple strains clustered together in time are expected to be more criminogenic (Agnew, 1992). As an extension of GST, Slocum (2010) suggested chronic stress – the outcome of a process termed stress proliferation – as a potential mechanism linking GST to persistence in offending. This idea states that as stressors accumulate, they can have primary and secondary effects on a person’s ability to cope, as well as one’s propensity for subsequent strain. The impacts of stress/strain can lead to difficulties in the same domain *and* other areas of a person’s life. The body of research on stress or strain proliferation and crime is small but seems to support this idea (Hoffmann & Cerbone, 1999; Hoffmann et al., 2000; Slocum, Simpson, & Smith, 2005). Additionally, Botchkovar and Broidy (2010) looked at stress proliferation and offending and found that instead of mediating the relationship between strain and crime, negative emotions were produced by the accumulation of stressors that can “heighten the crime-generating potency of other, less criminogenic strains” (pp.837). Dynamic processes are therefore important in explaining persistence in strain thus offending over longer periods of time.

Applying this logic to HRS in the current study, I found that visiting the ED multiple times in five years (thus multiple incidents of HRS clustered in time) significantly increased one’s odds of frequent arrest. In other words, accumulating HRS had a relationship with persistent offending over and above the presence of HRS in general. Experiencing multiple, different chronic conditions – another possible source of chronic strain – also predicted frequent arrest for adults in this sample. Outside of GST,

this is consistent with prior research that similarly found repeat ED contact to predict frequent arrest (Constantine et al., 2010; Frank et al., 2014).

GST is another way in which to conceptualize the relationship between substance abuse, mental illness and crime. More importantly, health strain and stress proliferation help us to understand why the presence of physical health issues like chronic conditions and multimorbidity also predicted frequent arrest and cross-system involvement. Research is needed to (1) provide more support for the concept of health-related strain with better, more theory-focused designs; and (2) discern what factors make certain people more susceptible to the criminogenic effects of poor health than others (i.e., why some frequently cycle and some do not).

### **Limitations**

Before turning to the important implications of this research, some limitations must be noted. First, despite the fact that crime has been declining in recent years (Walsh, 2019), Camden still reports the highest crime rate across all towns and cities in New Jersey. Additionally, many in the region know of Camden as a place to purchase hard drugs and solicit prostitution. People come from Philadelphia and other surrounding areas to engage in crime in Camden. While police have worked tirelessly to make significant changes in this city, it is still considered a largely impoverished and potentially dangerous place. Camden is a very data-rich city with a growing commitment to understanding cross-system involvement – driven in large part by work done by The Coalition. And because Camden is slightly anomalous in terms of its crime rate, and its residents potentially higher-need than the rest of the state, generalizing findings from another place back to Camden (where most of the need for services is) would be difficult. A focus on

the Camden community allows local providers to understand the distinct needs of their specific cross-system involved population in depth. A deep dive in one location also means providers will be able to use my findings (and those from The Coalition) to develop treatment recommendations for distinct clusters of need in real time and with real insight into their existing clients. And by comparing my findings to those from other studies in other places, I can add to the larger body of work on the factors and experiences that most contribute to problematic patterns of cross-systems involvement across locations.

The current study analyzed administrative data. This is not itself a limitation – but does inhibit the ability to understand individual perceptions of events. A mix of administrative and self-report data would have been ideal. Future research in this area should incorporate data directly from frequent cyclers including self-rated health, reasons for ED contact, experiences with the healthcare system, the role of arrest, barriers to primary care including issues with insurance coverage, treatment and potential bias from actors in the community, their perceived relationship between arrest and poor health, and so on. These were topics on which I did not have first-hand data but would have rounded out the discussion of mechanisms driving cross-system involvement.

Turning to limitations of my methodology, none of the group-based trajectory models produced “perfect” diagnostics; and final model selection required a lot of subjective decisions. I also used a group size criterion of at least 1% for each trajectory, which led to fewer groups in the final model than would have been produced if I had only followed the BIC value for model selection. Trajectories are only approximations, however, and the groups produced here were meaningful and useful for my purposes. In

addition, trajectory modeling allows for approximation of patterns as they develop over time (Nagin, 2005). Even considering the limitations to this methodology, this was still preferred over assigning cut-offs of number of system contacts to determine groups (especially “frequent” groups) like is done with classification methods like cluster analysis (Piquero, 2008). In other words, my final solution included groups that would not have been discerned had I used a cross-sectional method.

Growth mixture modeling (GMM) is another method that could have been employed to uncover distinct subgroups in longitudinal data. While similar to GBTM in its person-centered approach, GMM would have allowed me to model individual variation within each trajectory or group and see how different individual patterns of arrest and ED use are when compared to the average trajectory for their respective/assigned group (Frankfurt et al., 2016; Muthén, 2004). Perhaps it would have been valuable to be able to add to the discussion around how group members differ from each other in their group and not just differences between groups or trajectories. It was thought at the onset of this study, however, that the large sample size would be best understood using a slightly less complex methodology like GBTM. I also hypothesized that individuals within groups would be much more similar to each other than was evidenced by the lower AvePP values and less than perfect model diagnostics in general. In future research, perhaps methods other than GBTM should be considered in order to understand the extent of individual variation captured in some of the arrest and ED trajectory groups.

The diagnoses analyzed in this study were assigned at the time of an ED contact. Because I only looked at the first three diagnoses given at the ED, I did not have

indicators of pre-existing conditions. In general, I also did not know about issues an individual experienced but never contacted the ED to address. Findings should therefore be interpreted as health concerns for which a person was brought to the ED or sought ED services, and not just the existence of health issues or receipt of diagnoses in general.

Next, there are many constructs that were not included in the current administrative data – which constitutes the majority of the limitations to my findings and the most significant. For instance, the integrated data I analyzed did not have information on incarceration in jail or prison; nor were formal death records obtained. This means it is impossible to know whether incarceration and/or mortality were overrepresented in subgroups, or if these important factors could explain changes in system use trajectories that emerged.

Being black was predictive of frequent cross-system involvement. I did not spend much time interpreting this finding – perhaps regrettably so – because I felt racial implications of frequent cycling was outside of the scope of this dissertation. That being said, research has demonstrated that racial minorities particularly blacks often lack health insurance (Sohn, 2017), are more likely to live in poverty (U.S. Census Bureau, 2014), experience more environmental stressors linked to poor health, and to experience more chronic health conditions (Thorpe et al., 2016). Not digging deeper into the relationship between race, disadvantage and frequent cycling is a significant limitation of this study that should be rectified in future research on this topic.

Similarly, official data on homelessness and shelter use through the official homelessness information management system (HMIS) was not included. I also did not have data on insurance status, income, education, marital status and other important

covariates that relate back to disadvantage and poverty. These indicators, along with homelessness and housing instability, could in fact be driving frequent cycling for a large number of individuals, maybe even the majority. Research in criminal justice and public health tells us that concentrated, long-term disadvantage has countless implications for health and criminal offending. It is imperative for subsequent studies on this topic to incorporate multidimensional indicators of poverty and disadvantage including but not limited to official reports of street and shelter-based homelessness, employment and income level and access to healthcare services through insurance.

I also did not have data on number of inpatient admissions in order to determine the ratio of ED visits to admissions – an important descriptive measure mentioned by multiple providers that could distinguish between higher- and lower-need groups of ED users. In future work with these data, I plan to merge in inpatient contacts and any additional data now available from The Coalition. Lastly, cost data were not yet available. The Coalition has used approximations for descriptive purposes; but the exact cost billed for each visit could not be determined so these estimates were not included.

The data were not able to account for time off the street, as well as what systems a person was contacting and life events they were experiencing outside of the systems and time points represented by the data. Likewise, important factors like incarceration, increased mortality and time spent in a homeless shelter were not available to use as descriptive variables to differentiate between trajectory groups. During qualitative interviews, I asked for input around factors not covered in the quantitative data that play an important role in cross-system involvement. These insights made up for this data limitation in many ways, but not completely. Speaking of qualitative interviews, a

limitation worth noting is the natural flow of each interview did not lend itself to each research question being asked to each participant. In other words, each interview was slightly different in terms of how cross-system involvement was discussed and what aspects of the quantitative findings were emphasized.

In terms of arrest data, the categories/groupings employed did not differentiate between misdemeanors and felonies. I was therefore not able to analyze these issues separately. I chose to instead focus on crime type (versus charge seriousness); but this remains a limitation, nonetheless. I also did not have data on health system contacts other than the ED. This is a limitation because I was not able to determine the correlation between frequent ED use and contact with other health-related systems or institutions. Individuals with more access to primary care, for instance, likely contact the ED at a lower rate than people without a reliable or consistent primary care provider. Again, because of data limitations I could not test this assumption.

The current study was able to track events that did occur – like arrests by police and ED visits – and consider the impact of factors that were included – like gender, age, number of ED visits for a mental illness, or number of arrests for violent crime. Despite the limitations of these data, these steps still generated important information at the intersection of criminal justice and public health. Provider interviews were also able to contribute information about important factors not included in the administrative data. These interviews were one way in which to compensate for these significant limitations by filling in the gaps left by the quantitative data with first-hand knowledge not necessarily available elsewhere. From the data that were available, we were able to cull important findings to inform research, programming and policy.

## **Implications**

### ***Research Implications***

My findings have many important implications for research, practice and policy. Beginning with research, this study confirms that poor health is not just something a handful of justice-involved people experience but a defining characteristic of the criminal justice population. Arrestees in my sample visited the ED at a higher rate than non-arrestees for every health-related issue I examined from mental illness to substance abuse to chronic conditions to multimorbidity. Even younger arrestees (age 18 to 22) visited the ED at a disproportionate rate for a range of health conditions from minor to severe, acute to chronic. When researchers study the health of justice-involved people, the focus is usually on mental illness and substance abuse. Less often do studies examine physical health characteristics or ways in which all types of health issues and/or multimorbidity influence crime and justice system involvement. Researchers should systematically incorporate measures of physical health including illness, injury and chronic conditions into studies on the needs of justice-involved populations. More research is also needed on the pathways between all forms of poor health and crime as large gaps remain in our understanding of the causal direction of this relationship.

As number of arrests increased, I found health issues grew more complex and severe; and issues like depression, anxiety and suicide more prevalent. This echoes the findings of Lorvick and colleagues (2018) who linked unmet healthcare needs and depression to “CJ accumulation”. This also speaks to the process of stress proliferation, or the damaging impact of experiencing multiple strains clustered together in time (Slocum, 2010). In sum, these perspectives (and my findings) argue that contacting the

justice system more often, particularly when contacts are closer together in time, may have unique implications for subsequent health and well-being. Most extant research on health and crime measure justice system involvement using binary indicators like the presence of any arrest, incarceration, reincarceration, or membership in a frequent offender class which misses the distinct needs of people somewhere in the middle. Researchers should consider exploring the unique effects of “CJ accumulation” and the process of accruing arrests on health-related outcomes. It is important to consider what issues increase in prevalence and/or severity as justice system contacts add up.

Also related to physical health, multimorbidity was associated with frequent arrest and frequent cross-system involvement. This concept was measured in more than one way (i.e., mental illness and substance abuse; chronic conditions and substance abuse; mental illness, substance abuse and chronic conditions; 3 or more different chronic conditions); and all of these measures increased in prevalence across levels of system contact. Many studies have utilized measures of multimorbidity (Academy of Medical Sciences, 2018; Alhussain et al., 2017; Cuddeback et al., 2010; Mallik-Kane & Visser, 2008; Meyer et al., 2012); but few use a common definition or grouping of conditions. Future research is needed to determine what iterations of multimorbidity – or what specific cluster of issues – are most criminogenic and important to target for criminal justice and public health officials specifically. My findings suggest that cross-discipline issues play an important role in encouraging public system contacts.

I found as number of arrests increased, ED contact (thus public health system involvement) became almost inevitable. This extensive overlap means these systems should not be conceptualized as working in isolation. Any effort to understand and

address frequent arrest must incorporate information on contact with other systems given how likely it is for cross-system contacts to emerge. Future research using cross-sector data is therefore essential for painting a comprehensive picture of the needs of justice-involved people. Data should be shared in real time, and agencies should collaborate to fund programs and initiatives for their shared populations. This research-to-action type work is often supported by researcher-practitioner partnerships. Camden is a data-rich community thanks in large part to work by The Coalition which means cross-sector data is integrated and shared across systems. The Coalition employs researchers and programmers to support specific goals that use data-driven strategies to develop actionable interventions. Other locations without this infrastructure, however, must break down the data silos that exist between the justice system, public health and homelessness service providers. Then communities can begin to identify their shared populations in order to inform practice, save money and avoid redundant care. More studies also need to make use of integrated data systems as these datasets are rich for testing theory and hypotheses around the relationship between health, social issues and crime as well as the time-ordering of events and the influence of factors over time.

### *Poor Health as a Criminogenic Strain*

Regarding theory, this study found support for General Strain Theory (Agnew, 1992) and the concept that health issues can lead to crime. It should be noted that GST is just one potential explanation for the relationship between poor health and subsequent justice system involvement – albeit one that has received more empirical support than others. Another explanation was extended in a recent article by Link, Ward and Stansfield (2019) in which they describe a health-based model of desistance. Using

structural equation modeling with SVORI data, the authors found self-reported measures of physical health limitations and depression both had significant impacts on crime and reincarceration through family conflict, financial problems and barriers to employment. GST and the health-based model of desistance speak to the importance of understanding the role poor health plays in engendering stress, damaging relationships, impacting one's ability to acquire employment and making crime and recidivism more likely.

For the purpose of this discussion, I will focus on GST and health-related strain and what my findings can contribute to the discussion of this theory specifically. The presence of health strain (measured as contact with the ED) predicted more arrests for people in my sample, even young adults; and this relationship was reciprocal with arrest predicting more contact with the ED. These findings, although not causal, have implications for practice and policy, as well as research and theory. First by providing support for GST, my results suggest that poor health may not just be a correlate of justice system involvement but could be factor driving crime. As stated earlier, future research that is longitudinal in nature, tracking individuals from childhood through adult could help assess the temporal relationship. For policy and practice, if health issues are criminogenic, justice officials have vested financial and public safety-related interests in improving the health of people in the community in order to reduce arrest and incarceration. It also seems it is never too early in a person's adult life to begin these efforts as health influences crime across the lifecourse.

The reciprocal nature of the health/crime relationship also suggests diverting unhealthy people from the justice system whenever possible as increased involvement has a negative impact on health, thus subsequent arrest/incarceration and so on. A good

place to start is with programs that train police to resolve certain interactions by referring people to services in lieu of arrest. Pre-arrest and pre-jail diversion or “deflection” programs that focus on front-end or street-level interactions are growing in use and popularity across the U.S. (Center for Health & Justice at TASC, 2013). An example of a branded program with wide replication is Law Enforcement Assisted Diversion (LEAD). Originated in Seattle in 2011, LEAD is a pre-booking diversion program for low-level offenders (i.e., drugs and prostitution) that links participants to legal help and person-centered case management in lieu of arrest and prosecution (Clifasefi et al., 2017). These initiatives adopt a harm reduction orientation with the goal of breaking the typical cycle of arrest, re-arrest and incarceration by referring higher-risk people to services instead of further justice system involvement. Many additionally focus on people with mental health and substance abuse needs that are repeatedly encountered by police (Center for Health & Justice at TASC, 2013).

Police diversion programs are a newer trend, so the evaluation literature is still developing. Quasi-experimental evaluations of Seattle’s LEAD initiative, however, showed positive results for participants with a significant reduction in recidivism and odds of arrest; and improvements in the areas of housing, employment, income and health/benefits (Clifasefi et al., 2017; Collins et al., 2017). This is promising for the dozens of places that have begun to implement their own diversion and deflection programs. The framework/practice a community adopts must reflect their capacity for service referrals and the amount/type of resources available. It is essential that stakeholders develop strong partnerships and a comprehensive network of services that are evidence-based and easily accessible before, or alongside, the implementation of any

diversion program of this kind. For instance, a recent report contracted by the U.S. Department of Health and Human Services on existing jail diversion models found that cross-system collaboration was necessary for identifying high-risk people and intervening early (Pfefferle et al., 2019). Using community task forces and community meetings enhanced an initiative's ability to meet the complex needs of people in high-risk populations; and was pivotal for a program's long-term success. Building upon the extensive work already being done on crisis response particularly Crisis Intervention Teams (CIT), which traditionally focus on building awareness among police officers around mental illness, training for first responders including police must be developed and expanded (Watson et al., 2017; Usher et al., 2019). After the front-end work is done, however, research suggests communities will realize fewer frequent users, a better use of resources, improved health and criminal justice outcomes, and long-term cost-savings.

Related to stress/strain proliferation, I also found that multiple health issues clustered together in time increased one's odds of frequent arrest (Slocum, 2010). Making sure issues do not accumulate can therefore have an impact on reducing contact with the justice system. Policymakers should keep in mind the ways in which their policies add to one's "load" of stress and strain as this can have implications for how many systems a person touches and how often. For instance, the homelessness professional described the "ping-ponging" of people from one office to another just to seek/qualify for housing. Those without stable housing can be seen carrying their belongings through the streets, sleeping outside during the eligibility waiting period, getting sicker and more depressed. She also mentioned the many hurdles to getting state-sponsored mental health treatment even if a person is insured. To the extent that they make health worse, barriers to service

can themselves be criminogenic. Looking at systems on a more macro-level, by making housing easier to secure, or mental health/substance abuse treatment more prolific, we will see important change in the size and composition of the criminal justice population. This is a result of these systems being so closely intertwined.

Strain has important implications for desistance from crime. While research suggests people tend to naturally desist as they get older, many frequent cyclers in this sample were between 50 and 65 years old. Bob confirmed that older adults are a large share of the frequent user population in Camden. If poor health drives justice system involvement, and health issues only increase with age, we cannot reliably expect people to naturally end their involvement from crime as they get older. In other words, individuals are not thought to “age out” of the experience of strain/HRS or accumulated strain. This is an important finding that relates back to Piquero’s (2000) review of arrest trajectories. A recent systematic review of risk factors suggested that the difference between lifecourse persistent and adolescent limited offenders could be the number and magnitude of risk factors and not the presence of a specific factor or experience (Jolliffe et al., 2017). It could be that when a certain threshold of risk is met, persistent offending becomes more likely regardless of time or age of onset. This resonates with my results because I found that frequent cycling was representative of an accumulation of issues across domains.

GST provides a context for understanding why unhealthy people are overrepresented in criminal justice populations. The implications of GST and the criminogenic effect of health strain are many and warrant further attention. For now, these findings extend our understanding of how health influences criminal behavior and

one's vulnerability to victimization – both of which drive police interaction. Poor health is not just an unfortunate correlate of justice system involvement but is likely a key risk factor and driver of crime and deeper penetration into the system. The criminal justice system is responsible for the health of people incarcerated in prison (Estelle v. Gamble, 1976). There is no such requirement, however, for those who churn through other intercepts of the system. While not directly related to its overall mission of public safety, my findings around strain and the impact of poor health on crime imply that improving community health would reduce the size of the populations that overburden the criminal justice system at every intercept. These findings also show that the justice system should take part in more cost-, resource- and information-sharing with other public systems including but not limited to the hospital/ED. These systems are intertwined, and large-scale change will never come from working in isolation or remaining separate and siloed.

### ***Practice and Policy Implications***

#### *Frequent Cycling Initiatives*

No one should be arrested 20 or more times and visit the ED upwards of 100 times in the span of five years. Worse yet, it seems the most problematic patterns of cross-system cycling persist over many more years than five. For some, this cycling lasts a lifetime. It is difficult to imagine a scenario in which a healthy person with access to resources, a social support network, good coping skills and financial security would experience so many public system contacts. The simple existence of frequent cross-system involved people therefore calls for a range of programs and policies that cross domains. Frequent cross-system involvement is a manifestation of extensive cross-disciplinary needs that have so far gone unmet by traditional service approaches. We

would be doing a disservice to society as a whole if we continued to fail the most health-vulnerable and high-risk people living in our community.

Interventions across the U.S. have attacked this issue from different perspectives. From the healthcare side, hospital- and community-based initiatives have been developed to curb frequent use of the public hospital and/or ED. The Stanford Coordinated Care Model, for instance, was developed by health professionals in the ED to improve care coordination for the top 5% of patients responsible for a majority of healthcare spending (Richter, 2014). This model, which has since been adopted in other places, seeks to make people accountable for their health and able to manage their chronic conditions outside of the ED. The model uses a personalized approach to address the medical and non-medical needs of frequent users with supports that extend beyond the hospital/ED. Evaluations show fewer ED visits and hospital admissions for participants; and cost-savings for the hospital system overall in the form of less redundant and more efficient care (Lin et al., 2017). The California Frequent Users of Health Services Initiative similarly connected frequent users of the ED with a range of non-medical supports in the community. The initiative also saw success in the form of fewer ED visits, lower hospital costs, better housing stability/less homelessness among participants, and successful and lasting collaborations between different systems (Linkins et al., 2008).

Many hospital-based initiatives are now oriented around the social determinants of health which should, by definition, include criminal behavior (W.H.O., 2008). Programs do not regularly consider justice system involvement, however, or view crime as a risk factor for frequent ED contact (Linkins et al., 2008). My findings suggest any assessment of risk for disproportionate hospital/ED involvement should incorporate the

extent of one's prior contacts with the justice system including recent arrests and incarceration. Justice system involvement, particularly "CJ accumulation", has been shown to make poor health worse, public health system involvement more prevalent, and treatment more challenging.

Initiatives also exist that target individuals that cross systems and domains including criminal justice. For the most part, these programs focus on a small number of "super users" at the top of multiple distributions – usually long-term homeless people with multiple arrests, incarcerations, hospital/ED admissions. The Corporation for Supportive Housing's (CSH) FUSE initiative, for instance, serves chronically homeless individuals with serious mental health diagnoses who have spent years churning through jails, hospitals and shelters (Gilchrist-Scott & Fontaine, 2012). While exact definitions of "frequent use" vary across sites, programs that use the FUSE model provide supportive housing services and wraparound care to the most high-need and health-vulnerable individuals in a given community. Participants' lives are stabilized through case management and individualized treatment plans that cross domains.

Evaluations of FUSE show it is effective at reducing crisis service and homeless shelter use, incarceration, poor health outcomes, and homelessness/housing instability (Aidala et al., 2014). While communities save money in the long run, the up-front cost of these services can be high and are therefore only afforded to individuals with the most significant needs and longest-term patterns of cycling. For this reason, programs like FUSE designed for the most problematic user groups should represent only one prong of our approach to frequent cycling. My findings show that the health needs of people with fewer system contacts, but similarly problematic patterns of involvement, are also

important to consider. Addressing the needs of a larger population that includes those at risk of frequent cycling could prevent the most expensive forms of system involvement from developing in the first place. Without interventions for those farther upstream in this process – people at risk for repeat cross-system involvement but not at that level just yet – individuals will continue to transition into the frequent cyclist population.

### *Preventing Frequent Cross-System Involvement*

My findings suggest that once a person is cross-system involved, the presence of certain issues translates into higher odds of frequent cycling. These include substance abuse, co-occurring mental illness, chronic physical conditions, multimorbidity and exposure to violence. Instead of waiting to intervene until cross-system cycling becomes frequent, these are the factors we could target at the point of arrest or contact with the ED as a form of prevention. Depression also predicted frequent cycling for members of this sample; but instead of causing this behavior I would argue this is another consequence, like anxiety and suicide, that we can prevent by intervening earlier in the progression of cross-system involvement. In other words, “diseases of despair” may not cause frequent cycling; but cross-system contact can undoubtedly engender despair (Case & Deaton, 2015) – another important reason to intervene earlier.

Hospital systems often struggle with how to address the non-medical needs of individuals that appear repeatedly in the ED. Hospital social workers and staff are often too busy with other tasks to attend to these issues. Some hospitals have found funding to incorporate community health workers (CHWs) to link high-risk patients with services in the community. This could be a promising approach to preventing frequent cross-system cycling including justice system involvement among people who would benefit from

individualized, multidimensional care. For example, the IMPaCT model was developed by Dr. Shreya Kangovi and her team at the Penn Medicine Center for Health Care Innovation in Philadelphia (<https://chw.upenn.edu/about/>). At the center of this model are community health workers (CHWs) who are trained to know the service landscape and to match hospital patients to resources in the community based on their health and social needs. CHWs may make primary care follow-up appointments, help participants find housing, apply for jobs or job training, secure food and so on.

Participants are eligible for IMPaCT services if they are uninsured or receiving Medicaid; or live in low-income neighborhood. Their socioeconomic status therefore triggers eligibility and not their extent of system involvement. By widening the net in this way, programs like IMPaCT have the potential to reduce frequent cross-system cycling by preventing deeper penetration into the public health and criminal justice systems. A recent evaluation of IMPaCT at two sites found participants were more likely to follow up with primary care, to have better mental health, and to experience fewer readmissions (Kangovi et al., 2014). This model serves roughly 1,500 Philadelphians annually and has been adopted at more than 400 institutions across the country.

To extend this idea, I would argue for embedding CHW services in the waiting room of the ED and making them non-contingent on admission to the hospital/ED. For one, even people who do not otherwise engage in help-seeking behavior still interact with the ED. This makes the ED waiting room a meaningful intercept at which to engage people in hard-to-reach populations. Many the ED physician also mentioned what my findings and other research suggests – that most high-risk people especially the homeless are never admitted to the hospital following an ED contact. A meaningful number of

people with outstanding health and social needs therefore never make it past the ED waiting room. Under IMPaCT, CHWs interact with participants while in the hospital (i.e., post-admission). It would make a lot of sense to embed CHWs or initiatives in general in the waiting room of busy, urban EDs as well – or even more upstream like on the streets of high-risk communities. Since improving community health will have implications for public safety and crime reduction, the cost of hiring more CHWs for this purpose could be shared between the hospital and criminal justice systems. Cost-sharing and collaboration would increase the capacity for these programs to reach a larger group of people and reflect their recognition of their shared population.

Providers suggested better discharge planning at the point of release from any institution – jail, prison, the hospital, the ED, shelters, service offices, and so on. People with complex health needs must manage multiple conditions and navigate a fragmented healthcare and service environment. While people admitted to the hospital are afforded some level of discharge planning, individuals that never progress past the ED waiting room are not. This is another goal that would be served by expanding CHWs.

#### *A 5-Prong Approach to Frequent Cross-System Cycling*

In closing, I would suggest the following 5-prong approach to preventing and addressing frequent cross-system cycling in a given community. Without each of the following elements, the overall undertaking will likely fail at reducing the size of the frequent cycling population thus the suffering of our most health-vulnerable citizens.

- (1) Conduct a community-wide assessment of existing resources and service gaps in all relevant domains including health, housing, employment, reentry and education. Form partnerships and collaborate across systems to fill any gaps and

bolster existing programs. Centralize information for the benefit of stakeholders and the consumer; and share costs for new initiatives across systems.

- (2) Implement programs that divert people with health and social needs into community-based services in lieu of formal involvement with the justice system, particularly at the point of arrest.
- (3) Make comprehensive and person-centered care initiatives that utilize CHWs more widespread; and expand their scope to include CHWs in the ED waiting room (i.e., make service non-contingent on formal admission into any system).
- (4) Continue to implement programs for the most frequently service-involved people at the top of the distribution with the goal of reducing the size of this population over time. Collect data and conduct evaluations in order to demonstrate the cost-savings that happen when resources are allocated appropriately.
- (5) Put all of these initiatives under one umbrella with a board of shareholders that crosses domains and meets regularly. This will foster collaborations and long-term partnerships (including data-sharing agreements) that are essential for this work. Also provide people discharge planning/support at the time of release from any public system to a point person from this initiative so no one with significant and outstanding needs are ever released back to the community without the opportunity for support following contact with a public system.

### *Conclusion*

The overarching goal of the current study was to gain a deeper understanding of the patterns and dimensions of frequent cross-system involvement, or repeat cycling between the criminal justice and public health systems. A secondary goal was to

illuminate what factors work together to encourage or differentiate between various patterns of cross-system cycling. To this end, this study used rigorous statistical procedures to find that the most frequent joint trajectory groups (arrest and ED contact) exhibited significantly more ED visits to address injuries including skull-related injuries, chronic conditions, dental and skin issues, anxiety, depression, suicidal ideation, substance abuse and comorbidity measured as chronic conditions along with behavioral health concerns and drug/alcohol abuse. Arrests for disorderly and drug offenses and prostitution were also significantly more prevalent for frequent cross-system cyclers when compared to groups with fewer system contacts. Many of these factors were even more prevalent among a subsample of young adults aged 18 in 2010 with repeat contacts with both systems. The service provider interviews further described frequent cyclers as particularly health-vulnerable individuals with complex and multidimensional needs. These are important contributions to criminological research as discussion is often restricted to behavioral health and not physical health or comorbidity. This is also among the first research studies to dig deeper into diagnoses associated with frequent cycling. Factors that become more prevalent and significant as system contacts accumulate should be targeted early in the lifecourse in order to reduce cross-system cycling. Going forward, research and practice must continue to uncover how issues like chronic health conditions, depression, anxiety and “diseases of despair” work together with offending to put certain individuals in particularly vulnerable positions characterized by frequent system cycling. In particular, adopting the five-prong approach recommended above would have important implications for practice and policy, could save money, and improve public

safety and quality of life for the most health-vulnerable individuals with whom the justice system interacts.

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## APPENDIX A. IRB APPROVAL



Research Integrity & Compliance  
Student Faculty Center  
3340 N. Broad Street, Suite 304  
Philadelphia PA 19140

Institutional Review Board  
Phone: (215) 707-3390  
Fax: (215) 707-9100  
e-mail: [irb@temple.edu](mailto:irb@temple.edu)

### Certification of Approval for a Project Involving Human Subjects

Date: 03-Aug-2017

Protocol Number: 24573  
PI: ROMAN, CATERINA G.  
Review Type: EXEMPT  
Approved On: 03-Aug-2017  
Approved From:  
Approved To:  
Committee: A2  
School/College: LIBERAL ARTS (1800)  
Department: CLA:CRIMINAL JUSTICE (18350)  
Sponsor: NO EXTERNAL SPONSOR  
Project Title: Examining the Longitudinal Relationship between Emergency Department Utilization and Arrest Using Integrated Data from Camden, NJ: A Mixed-Methods Approach

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The IRB approved the protocol 24573.

If the study was approved under expedited or full board review, the approval period can be found above. Otherwise, the study was deemed exempt and does not have an IRB approval period.

If applicable to your study, you can access your IRB-approved, stamped consent document or consent script through ERA. Open the Attachments tab and open the stamped documents by clicking the Latest link next to each document. The stamped documents are labeled as such. Copies of the IRB approved stamped consent document or consent script must be used in obtaining consent.

**APPENDIX B. TABLE INCLUDING ALL VARIABLES USED IN ALL ANALYSES**

<u>TRAJECTORY VARIABLES</u>		
<b>ED_bin1 (OR) arrest_bin1</b>	Number of ED visits <b>(OR)</b> arrests, 01/01/2010 through 06/30/2010	#
<b>ED_bin2 (OR) arrest_bin2</b>	Number of ED visits <b>(OR)</b> arrests, 07/01/2010 through 12/31/2010	#
<b>ED_bin3 (OR) arrest_bin3</b>	Number of ED visits <b>(OR)</b> arrests, 01/01/2011 through 06/30/2011	#
<b>ED_bin4 (OR) arrest_bin4</b>	Number of ED visits <b>(OR)</b> arrests, 07/01/2011 through 12/31/2011	#
<b>ED_bin5 (OR) arrest_bin5</b>	Number of ED visits <b>(OR)</b> arrests, 01/01/2012 through 06/30/2012	#
<b>ED_bin6 (OR) arrest_bin6</b>	Number of ED visits <b>(OR)</b> arrests, 07/01/2012 through 12/31/2012	#
<b>ED_bin7 (OR) arrest_bin7</b>	Number of ED visits <b>(OR)</b> arrests, 01/01/2013 through 06/30/2013	#
<b>ED_bin8 (OR) arrest_bin8</b>	Number of ED visits <b>(OR)</b> arrests, 07/01/2013 through 12/31/2013	#
<b>ED_bin9 (OR) arrest_bin9</b>	Number of ED visits <b>(OR)</b> arrests, 01/01/2014 through 06/30/2014	#
<b>ED_bin10 (OR) arrest_bin10</b>	Number of ED visits <b>(OR)</b> arrests, 07/01/2014 through 12/31/2014	#
<u>KEY COVARIATES</u>		
<b>Ever ED contact</b>	Any ED visit between 2010 and 2014	0/1
<b>5 or + ED contacts</b>	Visited the ED 5 or more times between 2010 and 2014	0/1
<b>Ever ED – Year 1</b>	Any ED visit in 2010	0/1
<b>Ever ED – Year 2</b>	Any ED visit in 2011	0/1
<b>Ever ED – Year 3</b>	Any ED visit in 2012	0/1
<b>Ever ED – Year 4</b>	Any ED visit in 2013	0/1
<b>Ever ED – Year 5</b>	Any ED visit in 2014	0/1
<b>ED contacts (#)</b>	Number of ED visits between 2010 and 2014	#
<b>Ever Arrest</b>	Any arrest between 2010 and 2014	0/1
<b>5 or + Arrests</b>	Arrested 5 or more times between 2010 and 2014	0/1
<b>Ever arrest – Year 1</b>	Any arrest in 2010	0/1
<b>Ever arrest – Year 2</b>	Any arrest in 2011	0/1

<b>Ever arrest – Year 3</b>	Any arrest in 2012	0/1
<b>Ever arrest – Year 4</b>	Any arrest in 2013	0/1
<b>Ever arrest – Year 5</b>	Any arrest in 2014	0/1
<b>Arrests (#)</b>	Number of arrests between 2010 and 2014	#
<b>DEMOGRAPHICS</b>		
<b>Age (years)</b>	Age at the time of a person’s first system contact (years)	#
<b>Gender (male)</b>	Male gender assigned at the time of a person’s first system contact	0/1
<b>Race (black)</b>	Black non-Hispanic race assigned at the time of a person’s first system contact	0/1
<b>Race (white)</b>	White non-Hispanic race assigned at the time of a person’s first system contact	0/1
<b>Ethnicity (Hispanic)</b>	Any Hispanic ethnicity assigned at the time of a person’s first system contact	0/1
<b>PHYSICAL HEALTH VARIABLES</b>		
<b>Abdominal pain</b>	Any ED visit for abdominal pain (ccs_251)	0/1
<b>Chronic condition</b>	Any ED visit for one of the following chronic conditions: arthritis (ccs_201-203), asthma (ccs_128), cancer (ccs_011-047), chronic kidney disease (ccs_158), chronic obstructive pulmonary disease (COPD; ccs_127), diabetes (ccs_049, 050), hepatitis (ccs_006), HIV (ccs_005), hypertension (ccs_098, 099)	0/1
<b>3 or + chronic conditions</b>	Visited the ED to address 3 or more different chronic conditions	0/1
<b>3 or + ED (chronic conditions)</b>	Visited the ED 3 or more times for a chronic health condition	0/1
<b>Dental issues</b>	Any ED visit for dental issues (ccs_136)	0/1
<b>3 or + ED (dental issues)</b>	Visited the ED 3 or more times for dental issues	0/1
<b>Injuries (ever)</b>	Any ED visit for an injury (ccs_225, 226, 229-234, 239, 244)	0/1
<b>3 or + ED (injuries)</b>	Visited the ED 3 or more times for an injury	0/1
<b>Injures (#)</b>	Number of ED visits for an injury	#
<b>Skull-related injuries</b>	Any ED visit for a skull-related injury (ccs_228)	0/1
<b>Skin conditions</b>	Any ED visit for a skin condition (ccs_197-200)	0/1
<b>3 or + ED (skin conditions)</b>	Visited the ED 3 or more times for a skin condition	0/1
<b>Poisoning/overdose</b>	Any ED visit for poisoning/overdose (ccs_241, 242, 243, 2613)	0/1

<b>3 or + ED (poisoning)</b>	Visited the ED 3 or more times for poisoning/overdose	0/1
<b>STI</b>	Any ED visit for a sexually transmitted infection (STI; ccs_009)	0/1
<b>Wounds</b>	Any ED visit for a wound anywhere on the body (ccs_235, 236)	0/1
<u>MENTAL HEALTH VARIABLES</u>		
<b>Mental health (excluding SA)</b>	Any ED visit for mental health <i>not</i> substance abuse (ccs_650-659, 662, 663, 670)	0/1
<b>3 or + ED (MH excluding SA)</b>	Visited the ED 3 or more times for mental health (not SA)	0/1
<b>Mental health (excluding SA) (#)</b>	Number of ED visits for mental health (not SA)	#
<b>Anxiety</b>	Any ED visit for anxiety (ccs_651)	0/1
<b>Bipolar</b>	Any ED visit for bipolar, any type (ccs_657 – only ‘bipolar’ 6571)	0/1
<b>Depression</b>	Any ED visit for depression (ccs_657 – only ‘depression’ 6572)	0/1
<b>Depression (#)</b>	Number of ED visits for depression	#
<b>Schizophrenia</b>	Any ED visit for schizophrenia or other psychotic disorders (ccs_659)	0/1
<b>Suicide</b>	Any ED visit for suicide, ideation or clear attempts (ccs_662)	0/1
<b>Substance abuse</b>	Any ED visit for alcohol- or drug-related issues (ccs_660, 661)	0/1
<b>3 or + ED (SA)</b>	Visited the ED 3 or more times for alcohol- or drug-related issues	0/1
<b>Substance abuse (#)</b>	Number of ED visits for alcohol- or drug-related issues	#
<u>COMORBIDITY INDICATORS</u>		
<b>Co-occurring MH &amp; SA</b>	Visited the ED at least once for mental health (not SA) <u>and</u> at least once for substance abuse	0/1
<b>Chronic conditions + SA</b>	Visited the ED at least once for a chronic condition <u>and</u> at least once for alcohol- or drug-related reasons	0/1
<b>Chronic conditions + SA + MH</b>	Visited the ED at least once for a chronic condition <u>and</u> at least once for a mental health (not SA) <u>and</u> at least once for substance abuse	0/1
<u>ARREST VARIABLES</u>		
<b>Disorderly arrest</b>	Any arrest for a disorderly offense (e.g., disorderly conduct, harassment, creating a nuisance, conspiracy, criminal trespassing, driving with suspended license)	0/1

<b>Disorderly arrests (#)</b>	Number of arrests for a disorderly offense	#
<b>Drug arrest</b>	Any arrest for a drug charge (e.g., possession, paraphernalia, manufacture, distribution, loitering to sell/buy drugs, disorderly while under the influence, tampering with prescriptions, possession of hypodermic needle)	0/1
<b>3 or + arrests (drug)</b>	Arrested 3 or more times for drug charges	0/1
<b>Drug arrests (#)</b>	Number of arrests for drug charges	#
<b>Property arrest</b>	Any arrest for a property crime (e.g., shoplifting, theft, possession/sale/receipt of stolen goods, bad checks, fraud, burglary, breaking & entering)	0/1
<b>Prostitution arrest</b>	Any arrest for prostitution (e.g., promoting prostitution, engaging in prostitution, loitering for the purpose of prostitution)	0/1
<b>Violent arrest</b>	Any arrest for a violent offense (i.e., aggravated assault, simple assault, aggravated arson, assault on a public official (e.g., law enforcement, EMS), carjacking with threat of injury, kidnapping/criminal restraint, robbery, aggravated sexual contact, sexual assault/rape, assault with a firearm, threatening violence, bias intimidation, domestic violence, homicide and manslaughter)	0/1
<b>3 or + arrests (violent)</b>	Arrested 3 or more times for violent offenses	0/1
<b>Violent arrests (#)</b>	Number of arrests for violent offenses	#
<b>Weapons arrest</b>	Any arrest for a weapons offense (e.g., unlawful possession of a weapon, alteration of serial #, transporting weapons, distribution of weapons to minors)	0/1

## APPENDIX C. QUALITATIVE INTERVIEW GUIDE

### Flow of interview →

- Described purpose of this study → using a mixed-methods approach to better understand frequent cross-system involvement, or repeat contact with the criminal justice and public health systems during the same period of time
- Showed first version of Table 2 (arrestees vs. non-arrestees on reasons for ED contact)
- Showed arrest trajectories for full sample (Figure 1) and descriptive information for increasing and high groups (data from Table 3)
- Showed ED trajectories for full sample (Figure 2) and for young adults (Figure 5), and descriptive information for high ED group (data from Table 5)
- Shared data on the relationship between arrest and ED use
- Showed overview of joint trajectory groups (cross-tabulation), some descriptive information of high/high joint group

### Interview questions, corresponding research questions & codes →

**RQ7** When presented with the **trajectories** that emerge from quantitative analyses, do service providers feel they “ring true” and reflect their real-world experiences or observations? Are there any **factors** not included in the quantitative data that could help better describe or differentiate between groups?

#### questions posed to provider:

- 1) Do any of these trajectory groups “ring true” to you? If yes, which ones/how so? If not, why not? (**prompt** → why dental issues, skin conditions, prostitution, STIs/UTIs, chronic conditions, etc.)
- 2) What other factors should be considered? (**prompt** → homelessness, SES, social support, poverty, neighborhood disadvantage, violence/victimization, access to healthcare, education/employment, certain specific diagnoses, chronic conditions, co-morbidity, etc.)

#### codes re: specific trajectories:

TRAJECTORY GROUPS

#### codes re: factors associated with frequent cycling:

ACCESS TO SERVICES  
PHYSICAL HEALTH  
CHRONIC CONDITIONS  
SUBSTANCE ABUSE  
MENTAL ILLNESS  
COMORBIDITY  
VIOLENCE  
PROSTITUTION  
HOMELESSNESS

POVERTY  
OTHER FACTOR

What role does age play in system involvement, particularly cross-system cycling?

**question posed to provider:**

- 3) What is the role of age in cross-system cycling, especially frequent cycling?

**codes re: role of age:**

ROLE OF AGE

What services or approaches to treatment are best-suited to address the needs of individuals who frequently cycle between systems?

**question posed to provider:**

- 4) What would be the best service approach to address and/or prevent frequent cross-system involvement? What factors to target, for whom?

**codes re: treatment recommendations:**

RECOMMENDATIONS

EXISTING PROGRAMS

**codes added to capture themes across interviews & highlights from individual interviews:**

REASON FOR OVERLAP

HEALTH OF CJ POP

HIGHLIGHT

WHY PEOPLE USE ED

**APPENDIX D. CODING SCHEME FOR QUALITATIVE INTERVIEW &  
COUNTS FOR EACH CODE**

<b>Code</b>	<b># of N=6</b>	<b>Description</b>
TRAJECTORY GROUPS	5	[RQ7] Any specific mention by a Provider of the results of the group-based trajectory analysis. Includes mention/discussion of factors associated with a particular trajectory group, opinion of the trajectories in general (“ring true”?), differences between groups, responses to questions about specific trajectory groups, etc.
ACCESS TO SERVICES	6	[RQ7] Mention/discussion of the role of access to services in system involvement (single or joint, at all or frequently)
PHYSICAL HEALTH	6	[RQ7] Mention/discussion of the role of physical health issues
CHRONIC CONDITIONS	2	[RQ7] Mention/discussion of the role of chronic conditions
SUBSTANCE ABUSE	6	[RQ7] Mention/discussion of the role of substance abuse
MENTAL ILLNESS	6	[RQ7] Mention/discussion of the role of mental illness
COMORBIDITY	5	[RQ7] Mention/discussion of comorbid conditions – or 2 or more health conditions experienced at the same time (e.g., mental illness & substance abuse, multimorbidity)
VIOLENCE	4	[RQ7] Mention/discussion of the role of violence including injuries by violence, victimization, violent offending
PROSTITUTION	4	[RQ7] Mention/discussion of the role of prostitution
HOMELESSNESS	6	[RQ7] Mention/discussion of the role of homelessness/housing
POVERTY	3	[RQ7] Mention/discussion of role of poverty
OTHER FACTOR	6	[RQ7] Mention/discussion of the role of any other factor in system involvement (single or joint, at all or frequently)
ROLE OF AGE	5	Any mention of age including role of age in system involvement, issues associated with younger/older age
RECOMMENDATIONS	6	Recommendations for treatment, research, future directions. Includes specific treatment recommendations for individuals who cycle between systems.
EXISTING PROGRAMS	6	Mention of existing programs specifically for cross-system involvement, frequent flyers
REASON FOR OVERLAP	6	If a Provider mentions a reason (driver, mechanism) for cross-system involvement, specifically why a person might be involved with both systems (at all or frequently)

HEALTH OF CJ POP	5	Any specific mention of the health issues of criminal justice-involved populations
HIGHLIGHT	6	A particularly important or interesting point made by a Provider, whether or not it fits into a specific code above
WHY PEOPLE USE ED	5	Any time a provider proposed a reason for why certain individuals contact the ED, why frequent ED contact happens in some circumstances

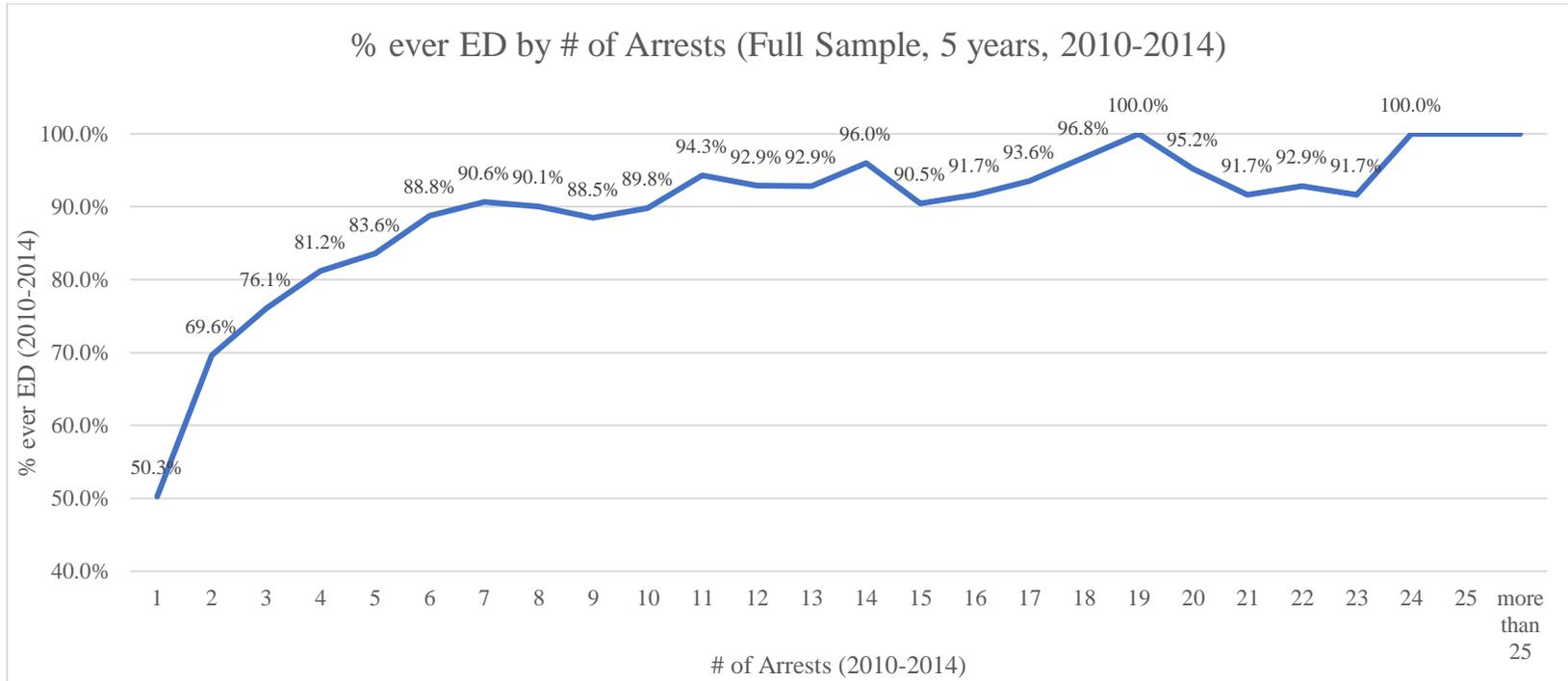
**APPENDIX E. ARRESTS AND ED USE BY YEAR (1-5) FOR ARREST AND ED TRAJECTORIES, YOUNG**

**ADULT SUBSAMPLE**

		<b>Increasing arrest (YA)</b>	<b>Low/zero arrest (YA)</b>	<b>Mid steady arrest (YA)</b>	<b>Mid steady ED (YA)</b>	<b>Low increase ED (YA)</b>	<b>Low decrease ED (YA)</b>	<b>High steady ED (YA)</b>
		<b>n=41</b>	<b>n=921</b>	<b>n=24</b>	<b>n=833</b>	<b>n=3,940</b>	<b>n=3,293</b>	<b>n=176</b>
<b>Arrests Y1 (ever)</b>	<b>%</b>	7.3%	12.1%	54.2%	3.24%	0.43%	0.97%	4.55%
<b>Arrests Y1 (#)</b>	<b>mean</b>	0.07	0.14	1.00	0.03	0.01	0.01	0.06
	<b>SD</b>	0.26	0.40	1.20	0.21	0.09	0.16	0.30
<b>Arrests Y2 (ever)</b>	<b>%</b>	14.6%	17.7%	79.2%	3.84%	0.56%	1.61%	9.09%
<b>Arrests Y2 (#)</b>	<b>mean</b>	0.20	0.20	1.60	0.04	0.01	0.02	0.13
	<b>SD</b>	0.51	0.45	1.30	0.22	0.10	0.20	0.51
<b>Arrests Y3 (ever)</b>	<b>%</b>	29.3%	29.6%	87.5%	7.32%	1.19%	1.94%	12.50%
<b>Arrests Y3 (#)</b>	<b>mean</b>	0.39	0.34	2.67	0.10	0.02	0.03	0.19
	<b>SD</b>	0.67	0.58	1.63	0.42	0.16	0.23	0.57
<b>Arrests Y4 (ever)</b>	<b>%</b>	61.0%	29.8%	62.5%	8.64%	2.13%	1.58%	10.80%
<b>Arrests Y4 (#)</b>	<b>mean</b>	1.69	0.38	1.67	0.14	0.03	0.03	0.15
	<b>SD</b>	2.17	0.68	2.04	0.58	0.25	0.28	0.48
<b>Arrests Y5 (ever)</b>	<b>%</b>	100.0%	37.4%	62.5%	10.56%	2.89%	1.88%	10.23%
<b>Arrests Y5 (#)</b>	<b>mean</b>	5.37	0.46	1.25	0.21	0.05	0.03	0.32
	<b>SD</b>	2.84	0.67	1.33	0.89	0.41	0.30	1.29
<b>ED visits Y1 (ever)</b>	<b>%</b>	19.5%	18.1%	37.5%	39.14%	1.70%	32.22%	73.86%
<b>ED visits Y1 (#)</b>	<b>mean</b>	0.39	0.37	0.79	0.67	0.02	0.42	2.53
	<b>SD</b>	1.14	1.06	1.28	1.09	0.13	0.72	2.71
<b>ED visits Y2 (ever)</b>	<b>%</b>	36.6%	32.1%	54.2%	39.14%	1.70%	32.22%	73.86%
<b>ED visits Y2 (#)</b>	<b>mean</b>	1	0.83	1.67	1.68	0.06	0.79	5.45
	<b>SD</b>	1.83	1.94	2.5	1.63	0.25	0.86	4.05
<b>ED visits Y3 (ever)</b>	<b>%</b>	51.2%	33.8%	66.7%	82.95%	27.74%	34.77%	96.59%
<b>ED visits Y3 (#)</b>	<b>mean</b>	1.4	0.84	1.67	2.11	0.33	0.47	6.23

	<b>SD</b>	2	1.7	2.4	1.72	0.60	0.75	4.94
<b>ED visits Y4 (ever)</b>	<b>%</b>	68.3%	32.8%	37.5%	84.51%	48.53%	10.23%	96.02%
<b>ED visits Y4 (#)</b>	<b>mean</b>	1.9	0.8	1	2.17	0.64	0.11	5.57
	<b>SD</b>	2.2	1.7	1.8	1.83	0.80	0.34	4.38
<b>ED visits Y5 (ever)</b>	<b>%</b>	58.5%	30.0%	45.8%	78.39%	50.30%	7.01%	89.20%
<b>ED visits Y5 (#)</b>	<b>mean</b>	2.4	0.67	0.79	2.05	0.69	0.07	5.01
	<b>SD</b>	3.6	1.4	1.3	1.97	0.88	0.27	4.30

**APPENDIX F. PERCENT OF PEOPLE THAT VISITED THE ED BY NUMBER OF ARRESTS**



**APPENDIX G. BREAKING OUT CHRONIC CONDITION GROUPING VARIABLE INTO INDIVIDUAL**

**DIAGNOSES FOR EACH TRAJECTORY GROUP**

	ARREST G1	ARREST G2	ARREST G3	ARREST G4	ARREST G5	ARREST G6	ED G7	ED G8	ED G9	ED G10
<i>n</i> <sup>^</sup> =	1630	212	250	1913	99	76	2988	37312	31586	16475
arthritis	3.9%	6.1%	2.4%	5.5%	0.0%	7.9%	11.5%	4.6%	4.2%	7.1%
asthma	29.1%	36.3%	40.8%	28.7%	34.3%	26.3%	44.6%	12.8%	12.5%	29.8%
cancer	5.5%	2.4%	2.8%	6.2%	5.1%	2.6%	11.1%	7.6%	7.7%	8.6%
chronic kidney disease	0.7%	0.5%	0.8%	1.6%	3.0%	0.0%	2.6%	1.9%	1.8%	2.9%
COPD	28.8%	25.0%	28.4%	27.4%	24.2%	26.3%	40.5%	14.3%	15.6%	29.2%
diabetes	23.6%	24.5%	22.8%	23.5%	15.2%	40.8%	29.3%	24.3%	22.6%	25.5%
hepatitis	5.6%	9.9%	3.6%	7.0%	18.2%	17.1%	5.4%	1.1%	1.1%	3.1%
HIV	1.8%	2.8%	2.8%	1.9%	2.0%	6.6%	1.9%	0.4%	0.4%	0.8%
hypertension	37.6%	33.0%	25.2%	40.1%	34.3%	35.5%	48.8%	52.6%	54.4%	48.3%

	joint G11	joint G12	joint G13	joint G14	joint G15	ARREST YA G16	ARREST YA G17	ARREST YA G18	ED YA G19	ED YA G20	ED YA G21	ED YA G22
<i>n</i> <sup>^</sup> =	169	33	68	32	107	8	68	0	96	106	99	49
arthritis	1.8%	9.1%	7.4%	6.3%	5.6%	0.0%	1.5%	0.0%	1.1%	1.5%	0.6%	0.0%
asthma	18.3%	30.3%	39.7%	31.3%	26.2%	50.0%	57.4%	0.0%	54.6%	51.7%	60.0%	70.0%
cancer	5.9%	6.1%	2.9%	0.0%	0.9%	0.0%	1.5%	0.0%	5.7%	6.3%	4.2%	2.9%
chronic kidney disease	0.6%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	1.1%	1.5%	0.0%	0.0%
COPD	23.1%	30.3%	29.4%	21.9%	25.2%	37.5%	32.4%	0.0%	28.4%	21.5%	20.6%	27.1%
diabetes	24.3%	54.6%	33.8%	31.3%	25.2%	12.5%	19.1%	0.0%	8.5%	6.3%	9.7%	8.6%
hepatitis	4.7%	15.2%	8.8%	21.9%	13.1%	12.5%	0.0%	0.0%	1.7%	1.5%	0.0%	1.4%
HIV	1.8%	9.1%	7.4%	6.3%	0.9%	0.0%	0.0%	0.0%	0.0%	1.5%	0.6%	0.0%
hypertension	32.5%	36.4%	50.0%	31.3%	26.2%	12.5%	11.8%	0.0%	14.2%	14.2%	10.3%	17.1%

<sup>^</sup> Only members of each trajectory/group that visited the ED for a chronic condition were included in this table.

## APPENDIX H. TRAJECTORY MODEL DIAGNOSTIC TABLES

### Arrest Trajectory Group Diagnostic Tables – Full Sample

**Table A1.** *BIC, Group Descriptions and Smallest Group Size for 2- through 6-Group Solutions: Arrest Trajectories, Full Sample (n=26,626)*

Number of groups	BIC	Group Descriptions	Smallest group (% of sample)
2 groups	-140289.45	1 low/zero; 1 increasing	4.8%
3 groups	-138738.68	2 low/zero; 1 increasing	3.8%
4 groups	-138075.40	3 low/zero; 1 increasing	3.9%
5 groups	-137737.67	4 low/zero; 1 increasing	3.8%
6 groups	-137100.29	4 low/zero; 1 increasing; 1 high/steady	0.9%

**Table A2.** *Average Posterior Probabilities for Trajectory Group Assignments: Arrest Trajectories, Full Sample (n=26,626)*

Assigned Arrest Group	Low/zero 1	Increasing	Low, spike Y3	Low/zero 2	Low, spike Y1	High
Low/zero (1) [G1]	<b>0.728</b>	0.013	0.028	0.227	0.004	0.000
Increasing [G2]	0.095	<b>0.818</b>	0.006	0.054	0.000	0.028
Low, spike Y3 [G3]	0.114	0.003	<b>0.544</b>	0.339	0.000	0.000
Low/zero (2) [G4]	0.112	0.007	0.081	<b>0.664</b>	0.134	0.001
Low, spike Y1 [G5]	0.006	0.000	0.000	0.251	<b>0.742</b>	0.001
High [G6]	0.000	0.072	0.002	0.034	0.004	<b>0.889</b>

**Table A3.** *Model Diagnostics for Final Model: Arrest, Full Sample, 6 Trajectories (n=26,626)*

Assigned Arrest Group	Group Size (% of total)	Odds of Correct Classification (OCC)	Average Posterior Probability (AvePP)	Difference Expected – Total Probability
Low/zero (1) [G1]	11,353 (42%)	3.61	0.73	0.06
Increasing [G2]	964 (4%)	119.93	0.82	0.00
Low, spike Y3 [G3]	2,266 (9%)	12.80	0.54	-0.01
Low/zero (2) [G4]	11,204 (42%)	2.72	0.66	0.01
Low, spike Y1 [G5]	612 (2%)	122.37	0.74	-0.05
High [G6]	227 (1%)	928.63	0.89	0.00

**ED Contact Trajectory Group Diagnostic Tables – Full Sample**

**Table A4.** *BIC, Group Descriptions and Smallest Group Size for 2- through 5-Group Solutions: ED Trajectories, Full Sample (n=414,942)*

Number of Groups	BIC	Group Descriptions	Smallest group (% of sample)
2 groups	-2730154.84	1 low/zero; 1 high	6.8%
3 groups	-2711150.93	2 low/zero; 1 high	6.4%
4 groups	-2664106.19	2 low/zero; 1 mid (steady); 1 high	1.0%
5 groups	-2651905.67	2 low/zero; 2 mid (increase, decrease); 1 high	0.8%

**Table A5.** *Average Posterior Probabilities for Trajectory Group Assignments: ED Trajectories, Full Sample (n=414,942)*

<u>Assigned ED Group</u>	Low increasing	Low decreasing	Mid/ steady	High
Low increasing [G7]	<b>0.78</b>	0.24	0.05	0.00
Low decreasing [G8]	0.21	<b>0.75</b>	0.04	0.00
Mid/steady [G9]	0.01	0.01	<b>0.90</b>	0.06
High [G10]	0.00	0.00	0.01	<b>0.94</b>

**Table A6.** *Model Diagnostics for Final Model: ED, Full Sample, 4 Trajectories (n=414,942)*

<u>Assigned ED Group</u>	Group Size (% of total)	Odds of Correct Classification (OCC)	Average Posterior Probability (AvePP)	Difference Expected – Total Probability
Low increasing [G7]	204,015 (49.2%)	3.71	0.78	0.00
Low decreasing [G8]	172,712 (41.6%)	4.26	0.75	0.00
Mid/steady [G9]	34,060 (8.2%)	100.42	0.90	0.00
High [G10]	4,155 (1.0%)	1531.81	0.94	0.00

**Arrest Trajectory Group Diagnostic Tables – Young Adult Subsample**

**Table A7.** *BIC and Group Descriptions for 2- through 6-Group Solutions: Arrest Trajectories, Young Adult Subsample (n=986)*

Number of Groups	BIC	Group Descriptions (% of total subsample)
2 groups	-5028.39	1 low (5.9%); 1 increasing/high (94.1%)
3 groups	-4996.67	2 low (42.7% & 52.3%); 1 increasing/high (5.0%)
4 groups	-4999.35	3 low (17.9% & 56.5% & 21.1%); 1 increasing/high (4.6%)
5 groups	-4986.25	4 low (33% & 11.7% & 11.5% & 39%); 1 increasing/high (4.9%)
6 groups	-4987.09	<i>*did not display groups</i>

**Table A8.** *Model Diagnostics for Final Model: Arrest, Young Adult Subsample, 3 Trajectories (n=986)*

<u>Assigned Arrest Group</u>	Group Size (% of total)	Odds of Correct Classification (OCC)	Average Posterior Probability (AvePP)	Difference Expected – Total Probability
Increasing arrest [G16]	41 (4.2%)	133.59	0.853	0.00
Low/zero arrest [G17]	921 (93.4%)	3.97	0.982	0.01
Mid steady arrest [G18]	24 (2.4%)	310.40	0.886	-0.01

**ED Contact Trajectory Group Diagnostic Tables – Young Adult Subsample**

**Table A9.** *BIC and Group Descriptions for 2- through 9-Group Solutions: ED Trajectories, Young Adult Subsample (n=8,242)*

Number of Groups	BIC	Group Descriptions (% of total subsample)
2 groups	-55025.20	1 low (91.2%); 1 high (8.8%)
3 groups	-54551.38	2 low (45.3% & 46.4%); 1 high (8.3%)
4 groups	-54373.49	2 low (42.1% & 45.4%); 1 mid/low (10.4%); 1 high (2.1%)
5 groups	-53669.85	3 low (45% & 11.7% & 30.9%); 1 mid/low (10.2%); 1 high (2.2%)
6 groups	-53621.14	<i>error from STATA</i>
7 groups	-53438.09	<i>1 group 0.8%</i>
8 groups	-53401.96	<i>1 group 0.8%</i>
9 groups	-53407.68	<i>error from STATA</i>

**Table A10.** *Model Diagnostics for Final Model: ED, Young Adult Subsample, 4 Trajectories (n=8,242)*

<u>Assigned ED Group</u>	Group Size (n; % of total)	Odds of Correct Classification (OCC)	Average Posterior Probability (AvePP)	Difference Expected – Total Probability
Mid steady ED [G19]	833 (10.1%)	53.29	0.857	0.00
Low increasing ED [G20]	3,940 (47.8%)	3.93	0.783	0.02
Low decreasing ED [G21]	3,293 (40%)	6.04	0.800	-0.02
High steady ED [G22]	176 (2.1%)	577.32	0.926	0.00

**APPENDIX I. RISK RATIOS COMPARING “LEVELS” OF CROSS-SYSTEM INVOLVEMENT**

**(LOW, MID, HIGH)**

**Table A11.** *Demographic, Health- and Justice-Related Characteristics of Joint Arrest/ED Trajectory Groups: 4 Most “Frequent” Cross-System Involved Groups and Low Arrest/Low ED Group for Comparison – Risk Ratios*

<u>Measure</u>	Joint Trajectory Groups					Risk Ratios		
	Joint [G11]	Joint [G12]	Joint [G13]	Joint [G14]	Joint [G15]	G11	G15	G12
	“low”	“high”			“mid”	vs. G15	vs. G12	vs. G11
	low arrest/ low ED (n=1,328)	high arrest/ high ED (n=46)	inc arrest/ high ED (n=104)	high arrest/ mid ED (n=107)	inc arrest/ mid ED (n=356)	“low” vs “mid”	“mid” vs “high”	“low” vs “high”
Age (years)	33.2 (11.2)	38.3 (11.4)	33.6 (10.3)	34.4 (10.3)	29.9 (9.9)	---	---	---
18-21 years old	17.9%	2.2%	11.5%	10.3%	23.9%	1.34	0.09	0.12
50-65 years old	8.7%	21.7%	8.7%	5.6%	5.9%	0.68	3.68	2.49
Gender (male)	79.0%	67.4%	60.6%	70.1%	84.0%	1.06	0.80	0.85
Race (black)	47.4%	63.0%	55.8%	43.9%	53.4%	1.13	1.18	1.33
Race (white)	29.2%	28.3%	17.3%	43.0%	26.4%	0.90	1.07	0.97
Ethnicity (Hispanic)	22.6%	8.7%	26.9%	13.1%	19.9%	4.50	0.44	0.38
ED contacts (#)	2.7 (1.6)	56.0 (59.9)	44.7 (44.1)	12.3 (4.2)	11.6 (4.3)	---	---	---
<i>range</i>	1-7	22-338	22-320	6-21	6-22	---	---	---
Abdominal pain	15.4%	67.4%	63.5%	28.0%	30.3%	1.97	2.22	4.38
<b>Chronic condition</b>	12.7%	71.7%	65.4%	29.9%	30.1%	<b>2.37</b>	<b>2.38</b>	<b>5.65</b>
<b>3 or + chronic conditions</b>	0.2%	13.0%	13.5%	4.7%	0.8%	<b>4.00</b>	<b>16.25</b>	<b>65.00</b>
<b>3 or + ED (chronic)</b>	1.7%	45.7%	36.5%	8.4%	8.7%	<b>5.12</b>	<b>5.25</b>	<b>26.88</b>
<b>Dental</b>	7.8%	45.7%	39.4%	21.5%	23.0%	<b>2.95</b>	<b>1.99</b>	<b>5.86</b>
<b>3 or + ED (dental)</b>	1.1%	28.3%	22.1%	6.5%	7.6%	<b>6.91</b>	<b>3.72</b>	<b>25.73</b>

Injuries	48.8%	95.7%	94.2%	78.5%	84.0%	1.72	1.14	1.96
<b>3 or + ED (injuries)</b>	9.2%	69.6%	69.2%	37.4%	41.3%	<b>4.49</b>	<b>1.68</b>	<b>7.57</b>
Injuries (#)	0.9 (1.2)	7.0 (7.6)	7.1 (7.5)	2.5 (2.5)	2.6 (2.5)	---	---	---
<b>Skull-related injuries</b>	1.5%	32.6%	16.4%	14.0%	9.0%	<b>6.00</b>	<b>3.62</b>	<b>21.73</b>
<b>Skin conditions</b>	16.1%	78.3%	72.1%	58.9%	56.7%	<b>3.52</b>	<b>1.38</b>	<b>4.86</b>
<b>3 or + ED (skin)</b>	2.3%	54.4%	48.1%	18.7%	19.9%	<b>8.65</b>	<b>2.73</b>	<b>23.65</b>
Poisoning/overdose	2.7%	21.7%	36.5%	26.2%	19.1%	7.07	1.14	8.04
<b>3 or + ED (poisoning)</b>	0.1%	10.9%	4.8%	8.4%	1.4%	<b>14.00</b>	<b>7.79</b>	<b>109.00</b>
STI	4.7%	10.9%	18.3%	10.3%	21.1%	4.49	0.52	2.32
Wounds	19.7%	80.4%	64.4%	47.7%	52.3%	2.65	1.54	4.08
<b>Mental health (excluding SA)</b>	11.6%	76.1%	81.7%	42.1%	38.2%	3.29	1.99	6.56
<b>3 or + ED (MH exc. SA)</b>	1.7%	52.2%	61.5%	24.3%	7.9%	4.65	6.61	30.71
Mental health exc. SA (#)	0.2 (0.7)	8.5 (24.4)	8.1 (13.0)	1.4 (2.3)	0.9 (2.0)	---	---	---
<b>Anxiety</b>	3.8%	52.2%	54.8%	18.7%	15.2%	4.00	3.43	13.74
<b>Bipolar</b>	0.8%	13.0%	16.4%	4.7%	2.0%	<b>2.50</b>	<b>6.50</b>	<b>16.25</b>
<b>Depression</b>	3.2%	47.8%	49.0%	20.6%	13.2%	4.13	3.62	14.94
<b>Schizophrenia</b>	1.1%	21.7%	25.0%	8.4%	3.9%	<b>3.55</b>	<b>5.56</b>	<b>19.73</b>
<b>Suicide</b>	1.2%	32.6%	36.5%	11.2%	7.0%	5.83	4.66	27.17
<b>Substance abuse</b>	13.5%	91.3%	77.9%	74.8%	51.7%	3.83	1.77	6.76
<b>3 or + ED (SA)</b>	1.0%	84.8%	61.5%	43.9%	25.3%	25.30	3.35	84.80
Substance abuse (#)	0.2 (0.6)	14.0 (39.2)	6.8 (9.3)	3.1 (3.5)	1.7 (2.6)	---	---	---
<b>Co-occurring MH &amp; SA</b>	4.4%	76.1%	70.2%	39.3%	27.3%	6.20	2.79	17.30
<b>Chronic conditions + SA</b>	2.0%	67.4%	51.9%	22.4%	21.4%	10.70	3.15	33.70
<b>Chronic conditions + SA + MH</b>	0.5%	58.7%	44.2%	11.2%	13.2%	26.40	4.45	117.40
Arrests (#)	2.0 (1.7)	23.3 (20.4)	11.1 (4.6)	19.5 (9.9)	11.0 (4.4)	---	---	---
	<i>range</i>	<i>1-20</i>	<i>9-124</i>	<i>5-25</i>	<i>8-59</i>	<i>5-32</i>	---	---
Disorderly arrest	36.1%	93.5%	93.3%	96.3%	81.5%	2.26	1.15	2.59
Disorderly arrests (#)	0.4 (0.7)	10.0 (16.3)	3.8 (3.1)	6.2 (5.8)	2.5 (2.3)	---	---	---
Drug arrest	32.5%	69.6%	56.7%	81.3%	78.9%	2.43	0.88	2.14

Drug arrests (#)	0.5 (1.0)	2.9 (3.3)	1.6 (2.1)	3.7 (3.3)	2.9 (2.9)	---	---	---
Property arrest	3.5%	41.3%	32.7%	38.3%	25.0%	7.14	1.65	11.80
<b>Prostitution arrest</b>	0.7%	26.1%	3.9%	25.2%	3.1%	<b>4.43</b>	<b>8.42</b>	<b>37.29</b>
Violent crime arrest	9.5%	21.7%	32.7%	27.1%	23.9%	2.51	0.91	2.28
3 or + arrests (violent)	0.2%	0.0%	5.8%	2.8%	1.7%	8.50	0	0
Weapons arrest	3.5%	6.5%	9.6%	7.5%	10.7%	3.06	0.61	1.86

\*\*\*  $p < .001$  (Bonferroni correction  $.05/48$  comparisons =  $.001$ )

Controlled for age in final trajectory models for the full adult sample.

Percentages (%) represent proportion of group with 'yes' on a dichotomous measure. For continuous measures, group means and (standard deviations) are presented.

## APPENDIX J. ADDITIONAL REGRESSION MODELS

**Table A12.** Binary Logistic Regression Models Using Health-Related Factors to Predict Membership in High [G6] and Increasing [G2] Arrest over Low Arrest [G1]

Predictor	Full Sample Arrest Trajectories					
	High Arrest [G6] (n=227)			Increasing Arrest [G2] (n=964)		
	B (SE)	OR	sig	B (SE)	OR	sig
Age (years)	0.02 (0.01)	1.02	*	-0.03 (0.00)	0.97	***
Gender (male)	0.04 (0.16)	1.05		0.91 (0.10)	2.48	***
Black	-0.03 (0.16)	0.98		0.41 (0.09)	1.51	***
Hispanic	-0.58 (0.22)	0.56	**	0.04 (0.11)	1.05	
<b>5 or more ED contacts</b>	0.76 (0.21)	2.14	***	0.56 (0.10)	1.76	***
ED – skin conditions	0.88 (0.16)	2.41	***	0.62 (0.08)	1.86	***
ED – poison/overdose	0.43 (0.20)	1.51	*	0.64 (0.12)	1.87	***
ED – substance abuse	1.46 (0.17)	4.29	***	0.85 (0.09)	2.34	***
ED – injury	0.27 (0.17)	1.30		0.42 (0.09)	1.52	***
constant	-5.74 (0.28)	0.00	***	-3.24 (0.15)	0.04	***
<i>Model x2 (df)</i>		384.08 (14)			817.40 (14)	
<i>Pseudo R2</i>		0.172			0.121	
<i>N</i>		11,580			12,317	

\*\*\* p > .001; \*\* p > .01; \* p > .05

Reference group is Low/Zero Arrest (1) trajectory [G1] (n=11,353)

Diagnoses were measured with binary variables (ever visited the ED for skin, poison, bipolar, substance abuse).

The following factors were also included in the model but did not reach statistical significance: any ED contact for chronic physical health conditions, dental issues, depression, anxiety, schizophrenia.

**Table A13.** Binary Logistic Regression Models Using Any ED and Number of ED Contacts to Predict Membership in Higher Arrest Trajectories, Young Adult Subsample

<u>Predictor</u>	Young Adult Arrest Trajectories					
	Increasing Arrest [G16] (n=41)			Mid Steady Arrest [G18] (n=24)		
	<i>B (SE)</i>	<i>OR</i>	<i>sig</i>	<i>B (SE)</i>	<i>OR</i>	<i>sig</i>
Black	-0.06 (0.33)	0.94		1.29 (0.48)	3.63	**
<b>Any ED contact</b>	1.87 (0.53)	6.47	***	1.83 (0.75)	6.25	*
constant	-4.53 (0.51)	0.01	***	-5.84 (0.77)	0.00	***
<i>Model x2 (df)</i>		19.22 (2)		21.13 (2)		
<i>Pseudo R2</i>		0.057		0.094		
<i>N</i>		962		945		

\*\*\* p > .001; \*\* p > .01; \* p > .05

Reference group is Low/Zero Arrest trajectory [G17] (n=921)

Gender was not included as a predictor because 100% of the increasing trajectory were male.

**APPENDIX K. DESCRIPTIVE TABLES RUN WITH ONLY INDIVIDUALS WHO  
RESIDED IN CAMDEN CITY BETWEEN 2010 AND 2014**

**Table A14.** *Descriptive Table Comparing Camden Residents to Individuals who were never Camden Residents between 2010 and 2014, on Demographics, Reasons for ED Contact, and Reasons for Arrest*

<u>Measure</u>	Never Camden Residents (n=360,416)	Camden Residents (n=64,773)	<i>sig</i>	Risk Ratio
Age (years)	45.5 (19.0)	38.7 (15.7)	***	---
Gender (male)	46.5%	52.9%	***	1.14
Race (black)	20.2%	49.5%	***	2.45
Race (white)	69.6%	9.6%	***	0.14
Ethnicity (Hispanic)	1.8%	15.6%	***	8.67
Ever ED contact	98.6%	92.3%	***	0.94
5 or + ED contacts	10.1%	35.4%	***	3.50
ED contacts (#)	2.3 (3.9)	5.4 (9.1)	***	---
<i>range</i>	0-464	0-386		---
Abdominal pain	21.6%	26.2%	***	1.21
Chronic condition	19.2%	29.7%	***	1.55
3 or + chronic conditions	0.7%	2.8%	***	4.00
3 or + ED (chronic cond.)	3.3%	11.3%	***	3.42
Dental issues	3.2%	9.6%	***	3.00
3 or + ED (dental issues)	0.7%	2.7%	***	3.86
Injuries	36.7%	41.6%	***	1.13
3 or + ED (injuries)	6.6%	13.1%	***	1.98
Skull-related injuries	0.7%	1.6%	***	2.29
Skin conditions	9.2%	21.7%	***	2.36
3 or + ED (skin conditions)	1.0%	5.1%	***	5.10
Poisoning/overdose	1.6%	2.8%	***	1.75
3 or + ED (poisoning)	0.1%	0.2%	***	2.00
STI	0.4%	4.7%	***	11.75
Wounds	11.5%	15.0%	***	1.30
Mental health (excluding SA)	8.9%	15.0%	***	1.69
3 or + ED (MH excl. SA)	1.7%	4.0%	***	2.35

Anxiety	3.9%	6.3%	***	1.62
Bipolar	1.0%	1.1%	p=.001	1.10
Depression	2.3%	4.3%	***	1.87
Schizophrenia	0.9%	1.9%	***	2.11
Suicide	0.6%	1.8%	***	3.00
Substance abuse	3.1%	8.5%	***	2.74
3 or + ED (SA)	0.4%	2.0%	***	5.00
Co-occurring MH & SA	1.3%	4.0%	***	3.08
Chronic conditions + SA	0.7%	3.3%	***	4.71
Chronic conditions + SA + MH	0.4%	2.0%	***	5.00
Arrests (#)	0.05 (0.40)	0.78 (2.32)	***	---
<i>range</i>	0-29	0-124		---
Disorderly arrest	1.0%	11.2%	***	11.20
Disorderly arrests (#)	0.01 (0.14)	0.18 (0.89)	***	---
Drug arrest	1.0%	7.5%	***	7.50
Drug arrests (#)	0.01 (0.17)	0.16 (0.77)	***	---
Property arrest	0.1%	2.4%	***	24.00
Prostitution arrest	0.1%	0.4%	***	4.00
Violent crime arrest	0.1%	4.2%	***	42.00
3 or + arrests (violent)	0.0%	0.2%	***	---
Weapons arrest	0.03%	1.4%	***	46.67
<b><i>BELOW – if 1 or + arrests</i></b>				
Arrests (#)	1.8 (1.7)	2.9 (3.8)	***	---
<i>range</i>	1-29	1-124		---
Disorderly arrest	39.1%	42.4%	***	1.08
Drug arrest	38.7%	28.1%	***	0.73
Property arrest	3.7%	9.0%	***	2.43
Prostitution arrest	2.3%	1.4%	***	0.61
Violent crime arrest	2.8%	15.9%	***	5.68
3 or + arrests (violent)	0.02%	0.6%	***	30.00
Weapons arrest	1.1%	5.3%	***	4.82

**Table A15.** Comparing Arrestees that never Resided in Camden to Camden Residents who were never Arrested between 2010 and 2014, on Demographics and Reasons for ED Contact

<u>Measure</u>	ED USE, NO ARREST (n=47,684)	ED USE & ARREST (n=12,112)	<i>sig</i>	Risk Ratio
Age (years)	40.3 (16.6)	33.5 (11.5)	***	---
Gender (male)	44.1%	76.7%	***	1.74
Race (black)	46.8%	58.9%	***	1.26
<b>Race (white)</b>	9.2%	11.8%	***	<b>1.28<sup>a</sup></b>
Ethnicity (Hispanic)	9.8%	28.9%	***	<b>2.95<sup>b</sup></b>
Arrests (#)	---	3.4 (4.2)	---	---
<i>range</i>	---	1-124	---	---
Ever ED contact	100%	100%	---	---
5 or + ED contacts	34.2%	54.7%	***	<b>1.60<sup>b</sup></b>
ED contacts (#)	5.2 (7.5)	8.7 (14.0)	***	---
<i>range</i>	1-246	1-386	---	---
Abdominal pain	28.5%	28.2%	***	0.99
Chronic condition	33.2%	28.3%	***	0.85
3 or + chronic conditions	3.2%	2.5%	***	<b>0.78<sup>b</sup></b>
3 or + ED (chronic cond.)	11.6%	10.2%	***	<b>0.88<sup>b</sup></b>
Dental issues	8.9%	16.3%	***	<b>1.83<sup>b</sup></b>
3 or + ED (dental issues)	2.4%	5.1%	***	<b>2.13<sup>b</sup></b>
Injuries	41.1%	60.9%	***	1.48
3 or + ED (injuries)	11.7%	24.0%	***	2.05
Skull-related injuries	1.1%	4.4%	***	<b>4.00<sup>b</sup></b>
Skin conditions	21.1%	33.1%	***	<b>1.57<sup>b</sup></b>
3 or + ED (skin conditions)	4.5%	9.4%	***	<b>2.09<sup>b</sup></b>
Poisoning/overdose	2.2%	6.1%	***	<b>2.77<sup>b</sup></b>
3 or + ED (poisoning)	0.1%	0.7%	***	<b>7.00<sup>b</sup></b>
STI	3.6%	11.0%	***	<b>3.06<sup>b</sup></b>
Wounds	12.6%	30.8%	***	<b>2.44<sup>b</sup></b>
Mental health (excluding SA)	14.0%	25.2%	***	<b>1.80<sup>b</sup></b>
3 or + ED (MH excl. SA)	3.3%	8.5%	***	<b>2.58<sup>b</sup></b>
Anxiety	5.9%	10.8%	***	1.83
Bipolar	0.9%	2.3%	***	2.56
Depression	3.7%	8.5%	***	<b>2.30<sup>b</sup></b>
Schizophrenia	1.6%	3.9%	***	<b>2.44<sup>b</sup></b>
Suicide	1.3%	4.8%	***	<b>3.69<sup>b</sup></b>

Substance abuse	5.4%	24.2%	***	<b>4.48<sup>b</sup></b>
3 or + ED (SA)	0.8%	7.8%	***	<b>9.75<sup>b</sup></b>
Co-occurring MH & SA	2.2%	12.7%	***	<b>5.77<sup>b</sup></b>
Chronic conditions + SA	2.0%	9.9%	***	<b>4.95<sup>b</sup></b>
Chronic conditions + SA + MH	1.1%	6.2%	***	<b>5.64<sup>b</sup></b>

<sup>a</sup> = 1 or more RR higher than full sample (not just Camden residents)

<sup>b</sup> = 1 or more RR lower than full sample (not just Camden residents)