Electronic Monitoring for Pretrial Release: Assessing the Impact

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A 2015 SURVEY of jail populations found that nationwide in the United States two-thirds of the incarcerated population in county jails are pretrial defendants awaiting a resolution for their case (Ortiz, 2015). The question of whether to detain or release defendants while they await trial is one of the most critical decision points in the pretrial phase, given its direct implications for operating costs and the jail population. In certain cases, pretrial detention may be justified for public safety or decreased flight risk, yet research suggests that it can also lead to negative collateral consequences such as job loss, weakened family bonds, increased likelihood of being convicted and sentenced to jail or prison, and increased probable sentence length if incarcerated (Phillips, 2008; Pogrebin, Dodge, & Katsampes, 2001). The use of electronic monitoring (EM) technologies to supervise pretrial defendants may prevent some of these collateral consequences, potentially increase the likelihood of court appearances compared to defendants released without EM, ensure compliance with certain conditions of release,

and alleviate the need to detain defendants at the jurisdiction's expense (DeMichele & Payne, 2009; Lemke, 2009; Wiseman, 2014).

EM technology was developed in the 1960s and started to be incorporated as an alternative sentencing option beginning in the 1980s (Dhungana Sainju et al., 2016). Shortly thereafter, EM was incorporated into the pretrial phase of the justice system and has been used to supervise defendants awaiting trial for over 20 years (Cadigan, 1991; Maes & Mine, 2013; VanNostrand, Rose, & Weibrecht, 2011). A recent census of EM use in the United States highlighted a sharp increase among pretrial defendants and convicted offenders, reporting that individuals monitored with global positioning system (GPS) and radio frequency (RF) bracelets rose almost 140 percent between 2005 and 2015 (Stevenson, Fahy, & Dhungana Sainju, 2016). While the use of EM technologies has primarily been focused on post-conviction populations, an increasing number of pretrial agencies are also incorporating its use to enhance pretrial release. Two surveys conducted among U.S pretrial

agencies found that more than two-thirds of agencies reported using EM technologies to supervise defendants (Erez et al., 2012; Pretrial Justice Institute, 2009). Based on the more recent numbers from the national census, it would be reasonable to postulate much higher present-day usage of EM technologies within pretrial agencies nationwide.

The implementation of EM at the pretrial phase differs between jurisdictions; however, this study will focus on the application within the county of Santa Clara, California. The current study examines EM as a condition of pretrial release for a general population of adult defendants. It adds to the limited research on pretrial EM programs and discusses EM use within this phase of the justice system.

Literature Review

Despite the growing use of EM, the research on the overall use of it as a supervisory tool has not kept pace (Dhungana Sainju et al., 2016). Earlier examinations of EM suffered from methodological limitations, including

the absence of comparison groups or inappropriate matching procedures. A meta-analysis covering studies conducted through 2002 concluded that the data did not provide enough evidence to support the effectiveness of EM in reducing crime (Renzema & Mayo-Wilson, 2005). More recent studies have attempted to address the previous shortcomings and suggest that EM may be effective in reducing recidivism rates (Bales et al., 2010; Di Tella & Schargrodsky, 2013; Erez et al., 2012; Gies et al., 2012; Gies et al., 2013; Padgett et al., 2006; Wolff et al., 2017). An updated meta-analysis released in 2017 reflects some of these results; however, overall the use of EM still did not lead to statistically significant reductions in re-offending rates. Nevertheless, there were some positive effects for certain types of offenders, such as sex offenders, as an alternative to a prison sentence and as part of specific conditions of release (Belur et al., 2017). The authors of the meta-analysis very aptly point to the complexity in measuring the effectiveness of EM programs given that jurisdictions have varying measures of success and use of the technologies (Belur et al., 2017). The majority of the studies conducted on EM to date examine post-conviction use of EM, and while there are a few outdated and a handful of more recently published studies based on pretrial populations, most suffer from the same issues noted above or focus on domestic violence defendants.

A study conducted in Lake County, Illinois, compared defendants supervised with EM against those who did not have a condition of EM during their release and found that those not placed on EM had a significantly greater number of new arrests and failure to appear (FTA) rates (Cooprider & Kerby, 1990). In contrast, a study of federal defendants on pretrial release found that those electronically monitored had a modest increase in their FTA and re-arrest rates (Cadigan, 1991). Comparing the use of EM for pretrial versus post-conviction programs in the same jurisdiction, Maxfield and Baumer (1990) found that unsuccessful dispositions were more common among the pretrial population. In a follow-up study, the authors noted that success on pretrial house arrest was more likely if the defendant had suitable living arrangements and if the criminal record was limited to minor offenses (Maxfield & Baumer, 1992). A 2009 pilot study of an EM program in Mesa County, Arizona, examining 151 misdemeanor defendants reported that pretrial release with a condition of EM and a reminder

call the day before the defendant's court date significantly reduced failure to appear in court (Lemke, 2009).

However, the studies mentioned above fail to properly account for the differences between the comparison groups or did not have a comparison group at all. There have been a few recent studies that use more statistically rigorous methods and appropriate comparison groups. Erez et al.'s 2012 study revealed that defendants who were placed on GPS monitoring were less likely to violate their curfew orders or be re-arrested (Erez et al., 2012). Furthermore, the effectiveness of EM was found to increase when paired with other sanctions that required the defendant to receive a form of treatment while being monitored (Gur, Ibarra, & Erez, 2016). Both of these studies, however, focused on the use of EM for domestic violence-related charges. Finally, Wolff et al.'s 2017 study examined a matched sample of defendants from the federal pretrial services agency in the district of New Jersey and found that defendants placed on EM were less likely to get arrested for a new crime compared to defendants not placed on EM. There were no significant differences in FTA or technical violation rates between the two groups. Given the limited number of studies on the impact of EM in the pretrial context, there is still a considerable need for additional research, and this study fills an important gap in the literature.

The Current Study

The current study is an examination of the Electronic Monitoring Program (EMP) as a condition of pretrial release within the Office of Pretrial Services in the County of Santa Clara, California. The study uses a quasi-experimental research design and propensity score matching which allows for matched sample comparisons consisting of a "*treatment*" group, defendants placed on EM, and a "*control*" group of similar pretrial defendants not on EM. The study looks to examine the difference in pretrial misconduct outcomes between those released with EM as an added condition of pretrial release and those released on supervision without a condition of EM.

The Program

In 2011, the state of California passed Assembly Bill (AB) 109, commonly referred to as *Realignment*, which stipulated that all non-serious, non-violent, or non-sexual offenders will serve their time in county jail rather than in state prison, leading to

an increase of offenders in California's jail population and resulting in counties assuming greater responsibility for individuals who may have previously faced a state prison commitment. To address the issue of jail overcrowding created by AB 109, Santa Clara County received AB 109 funding to implement an electronic monitoring contract and the county began its Electronic Monitoring Program (EMP) in early 2013.

In Santa Clara County, pretrial defendants who have been granted release are released via their own recognizance (OR) or via the supervised own recognizance release program (SORP). The OR release defendants do not have any supervision requirements. They receive a reminder letter of their court date and an automated phone call, but no contact with an officer is required. On the other hand, the SORP defendants are all released with the requirement that they attend regular weekly check-ins and with a list of release conditions, which can include an added level of supervision with EMP as a supervisory release condition. Each defendant undergoes a thorough risk assessment and is screened to ensure that certain technical requirements are met for the proper use of the equipment prior to being placed on the program. The presiding judge also considers recommendations provided by the pretrial court officer, the defendant's charges, prior criminal history, and any investigative reports to determine if a defendant should be placed on EMP. One of the options within the EMP is house arrest as an alternative to confinement in county jail. The use of GPS ankle bracelets allows the department to track the movement of a defendant to help determine compliance with the conditions of release. The defendant can also be assigned to a Remote Alcohol Monitoring (RAM) device that detects the alcohol concentration level in the defendant's breath by requiring the defendant to blow into the device. For visual verification, the device also snaps a picture of the individual taking the test, and both the image and alcohol reading are transmitted electronically. Testing is conducted randomly throughout the day.

Data and Measures

All the data for the current study were provided by the Office of Pretrial Services in Santa Clara County, California. The sample included defendants released between June 1, 2013, and December 31, 2015, on pretrial release status from the Santa Clara County jail. The participants included only those with

closed cases, meaning that they had completed their supervision term; each defendant either successfully completed his or her term without getting revoked, or was revoked due to a new arrest, technical violation, or failure to appear. Only defendants released under the supervised own recognizance release program (SORP) were included in the sample. Within the SORP sample, those placed on EM (either GPS or RAM) were identified as the "*treatment*" group and SORP defendants not placed on EM were identified as the "*control*" group.

Outcome Variables

Santa Clara County pretrial outcome measures reflect the recommendations made by the National Institute of Corrections (NIC, 2011). Appearance rate is the percentage of supervised defendants who make all scheduled court appearances, and the current study measured this outcome with revocations due to a failure to appear (FTA). Safety rate refers to supervised defendants who are not charged with a new offense during the pretrial stage and is measured by revocations due to a new arrest. Last, technical compliance is defined as following all conditions of release, and this was measured by revocations due to a technical violation. Technical violations are behaviors that are not in and of themselves a criminal offense but rather a violation of supervision conditions, such as failing to report for a scheduled office visit or failing to charge the EM device or entering their exclusion zones (geographic areas which the defendant is restricted from entering, such as the victim's home, work, etc.). Technical violations are defined as either a minor or major infraction. Most minor infractions are handled at the pretrial officer's discretion without a revocation and can often include a warning, or the defendant may have the conditions modified to respond to the violation. The more serious technical violations such as tampering with the EM device, contact with a protected person(s), or repeated patterns of misbehavior can result in a revocation and return to jail. The technical violations outcome in this study includes only violations that resulted in a revocation.

Matching Variables

A set of matching covariates was identified based on previous empirical studies on EM (Bales et al., 2010; Gies et al., 2012; Gies et al., 2013 etc.) as well as what Nagin, Cullen, and Jonson (2009) advocate as the minimum critical variables that should be taken into

account: gender, age, race, current offense, and prior record. The current study was able to match on all of these variables. The defendant's current charge was classified as a violent, property, drug, sex, or other offense. In addition, the current charge was identified as a felony or a misdemeanor, and charges were also broken out by those that involved domestic violence, physical injury to a victim, or an armed defendant. Prior criminal history was measured by the number of prior misdemeanors, number of prior driving under the influence (DUI) charges, prior parole cases, prior technical violations, prior FTAs, prior juvenile cases, number of prior other arrests, and the number of prior prison commitments.

All SORP releases are subject to five general supervisory conditions. Since these applied to both the treatment and control groups, they did not have to be included as matching variables. However, in addition to the general conditions, there were an additional 10 special conditions that may be applied based on the defendant's current charge and circumstances. Given that both groups are assigned these sets of conditions based on their offense and prior history, it was important to include the special conditions in the matching as well. In total, the treatment and control group were matched on 36 variables. All variables included did not affect the assignment of EM included in the model, and the data for both the EM and non-EM groups stem from the same data sources. See Table 1 for the full list of matching variables.

Analytic Strategy

We used propensity score matching to minimize the selection bias, balance the two groups, and ensure that the treatment group and the control group closely resembled each other on key variables. The propensity score was estimated using the set of covariates in Table 1 and was done using logistic regression where the treatment assignment was the outcome variable (EM versus Non-EM) and the selected covariates were the predictors. A nearest neighbor 1:1 matching without replacement was employed. Given that nearest neighbor matching without replacement estimates depends on the order in which the observations get matched, the ordering was randomly done. Additionally, since the use of nearest neighbor also risks the possibility of poor matches if the nearest neighbor is too far away, a caliper or a maximum allowable distance of 0.2 was imposed. This ensured that poor matches were avoided and the quality of

the matching was increased.

The original sample included a total of 6,090 SORP defendants, of whom 220 were placed on EM and 5,870 were not assigned EM. After cleaning the data and dropping cases that included missing variables, the sample was refined down to include 210 EM ("*treatment*") and 4,545 defendants not on EM ("*control*") for the pre-matching sample. No baseline item included in the propensity score matching procedure contained missing data. An additional check for the overlap and region of common support between the treatment and control group was conducted through a visual analysis of the density distribution of the propensity scores in each group. Furthermore, a Minima and Maxima comparison was conducted where the observations whose propensity scores were smaller than the minimum and larger than the maximum in the opposite group were deleted. Only one observation was outside this region and was discarded from the analysis. The final sample after propensity score matching procedures resulted in a sample of 416 defendants; 208 in the EM or "*treatment*" group and 208 in the non-EM or "*control*" group. Within the "*treatment*" group there were 113 defendants assigned to GPS and 95 assigned a RAM device.

Each of the three outcomes, revocation due to a new arrest, a technical violation, and failure to appear, was assessed with a survival analysis of time-to-event using a Cox proportional hazards model. The time variable for all outcomes was the days on supervision, calculated using the supervision start date and the end date (either the successful completion date or the revocation date). EM versus Non-EM was included as a treatment variable with no other covariates. Prior to the propensity score matching procedure, Independent Sample T-tests were conducted to examine the differences between the control and treatment group. This step helped to identify any imbalance between the two groups and allowed us to examine the pre-matching baseline characteristics of the groups. Significant differences were found among several variables between the treatment and control group. Table 1 (next page) highlights the differences in pre-matching baseline characteristics.

Results

To assess whether the matching procedure was able to balance the distribution of the relevant covariates in both the control and treatment group, T-tests were conducted again after the

TABLE 1
Pre-matching Baseline Statistics

Measure	Control (Non-EM) Group (Mean or %)	Treatment (EM) Group (Mean or %)
Age	34.20 years old	34.07 years old
Gender	Males: 76%; Females: 24%	Males: 85%; Females: 15% **
Race – White	29.4%	24.7%
Race – Black	10.4%	11.3%
Race – Hispanic	48.8%	50.4%
Race – Asian	8.1%	9.5%
Race – Other	2.5%	2.8%
Substance abuse problem	30%	21% **
Primary offense – Violent	20%	19.9%
Primary offense – Property	18.6%	18.5%
Primary offense – Drug	43.7%	38.5%
Primary offense – Sex	2.8%	7.1% **
Primary offense – Other	14.6%	15.2%
Prior misdemeanors	2.89	1.79 ***
Prior DUIs	.47	.79 ***
Prior parole cases	.23	.18
Prior violations	.12	.13
Prior FTAs	1.10	.29 ***
Prior juvenile cases	.19	.11 **
Prior other arrests	.29	.17 ***
Prior prison commitments	.38	.40
Primary charge – Felony	73.9%	69%
Primary charge – Misdemeanor	25.9%	30.7%
Armed defendant charge	.42%	1.9%
Domestic violence charge	3.1%	3.3%
Victim injury charge	.35%	1.9%
Special condition 1 – do not use or possess illegal drugs/ alcohol	66.9%	62.8%
Special condition 2 – submit to drug / alcohol testing	54.8%	52.3%
Special condition 3 – participate in drug/alcohol/psychological counseling	48.4%	42.3%
Special condition 4 – permit search and seizure of person, residence and vehicle without search warrant	43.2%	25.4% ***
Special Condition 5 – do not operate motor vehicle without valid license and proof of insurance	13.7%	17.1%
Special Condition 6 – do not possess any weapons while case is pending	10.7%	1.4% ***
Special Condition 7 – do not harass, threaten, attack etc. protected person(s)	4.5%	.48% ***
Special Condition 8 – no contact except through attorney with protected person – stay 300 yards away	2.7%	0% ***
Special Condition 9 – must reside at following address unless granted permission to live elsewhere	3.8%	0% ***
Special Condition 10 – defendant to post bail in amount of xx	.2%	0%

*Note: Sample size Non-EM group =4,545; EM group = 210. * p<.05, ** p<.01, ***p<.001*

propensity score matching, which showed that the covariates were balanced in both groups; no imbalances or significant differences remained. Additionally, the overall χ2 balance test was not significant (Hansen & Bowers, 2008) and the L1 measure was larger in the unmatched sample (.995) than in the matched sample (.967), also indicating that matching improved overall balance (Iacus, King, & Porro, 2009). Once the groups were balanced, descriptive statistics were examined across the treatment and control group. See Table 2 for post-matching baseline characteristics.

The largest racial group consisted of Hispanics, at 47.6 percent for the non-EM and 50 percent for the EM group. This was followed by Whites, 28.3 percent for the non-EM and 25 percent for the EM, and Blacks at approximately 12 percent of the sample. The most common primary offense was a drug offense, 36.5 percent and 38.9 percent for the non-EM and EM groups respectively, followed by violent offenses, 18.2 percent for non-EM and 19.2 percent for EM. Approximately 69 percent of the charges in both groups were felonies and 31 percent were misdemeanors. Only .48 percent of the cases in the non-EM and 1.9 percent of the cases in the EM groups included an armed defendant charge. Similarly, only a small percentage, 1.4 percent, in the EM group included a victim injury charge, and no cases in the non-EM group included a victim injury charge. About 61 percent of defendants in each group were assigned to a special condition that stipulated no use or possession of illegal drugs or alcohol, and about 50 percent of each group was required to submit to drug and alcohol testing.

Those in the EM group were supervised for an average of 128.5 days versus 112.1 days for the non-EM groups. Taking a closer look at the differences within the EM group, the GPS-supervised defendants were found to be supervised longer, on average 149.12 days, compared to the defendants on RAM, with an average of 100.43 days.

Prior to running the survival analysis model, the raw outcome data were examined using chi-square tests to look for group differences. The tests showed that there were statistically significant differences in getting revoked for a technical violation and FTAs, but not for new arrests. Next, each outcome was assessed with a survival analysis of time-to-event using a Cox proportional hazards model. The survival analysis found that the EM group had a hazard rate that was 3.39 times higher than the non-EM group for

TABLE 2
Post-Matching Baseline Statistics

Measure	Non-EM Group (Mean or %)	EM Group (Mean or %)
Age	35.31 years old	34.08 years old
Gender	Males: 86%; Females: 14%	Males: 84%; Females: 16%
Race – White	28.3%	25%
Race – Black	12%	11.5%
Race – Hispanic	47.6%	50%
Race – Asian	8.1%	9.6%
Race – Other	2.8%	2.8%
Substance abuse problem	23%	22%
Primary offense – Violent	18.2%	19.2%
Primary offense – Property	17.3%	18.7%
Primary offense – Drug	36.5%	38.9%
Primary offense – Sex	10.5%	7.2%
Primary offense – Other	14.6%	15.2%
Prior misdemeanors	1.89	1.81
Prior DUIs	.83	.77
Prior parole cases	.22	.17
Prior violations	.09	.13
Prior FTAs	.25	.29
Prior juvenile cases	.06	.12
Prior other arrests	.15	.17
Prior prison commitments	.51	.39
Primary charge – Felony	69.7%	69.2%
Primary charge – Misdemeanor	30.2%	30.7%
Armed defendant charge	.48%	1.9%
Domestic violence charge	3.8%	3.3%
Victim injury charge	0%	1.4%
Special condition 1 – do not use or possess illegal drugs/ alcohol	60.5%	62.5%
Special condition 2 – submit to drug / alcohol testing	49.5%	51.9%
Special condition 3 – participate in drug/alcohol/psychological counseling	37.9%	41.8%
Special condition 4 – permit search and seizure of person, residence and vehicle without search warrant	22.6%	25%
Special Condition 5 – do not operate motor vehicle without valid license and proof of insurance	11%	16.8%
Special Condition 6 – do not possess any weapons while case is pending	1.4%	1.4%
Special Condition 7 – do not harass, threaten, attack etc. protected person(s) xx	.96%	.48%
Special Condition 8 – have no contact except through attorney with protected person – stay 300 yards away	0%	0%
Special Condition 9 – must reside at following address unless granted permission to live elsewhere	0%	0%
Special Condition 10 – defendant to post bail in amount of xx	0%	0%

Note: Sample size Non-EM group =208; EM group = 208

getting revoked for a technical violation, Exp(B) 3.396 (p<.001). No significant difference was found in the hazard rate between the two groups for revocation due to a new arrest, Exp(B) 1.01 (p=.982). And last, for the failure to appear outcome, Exp(B) .341 (p<.000), the results suggest that the EM group had a 66 percent reduction in the hazard rate of getting revoked for an FTA compared to the non-EM group. See Table 3 (next page) for the survival analysis results.

The number of defendants revoked for a technical violation was not especially high, representing just over 4 percent (n=9) in the non-EM group and about 17 percent (n=35) in the EM group. These revocations also represent violations among closed cases over a span of two and half years. However, the finding that the EM group had a hazard rate that was 3.39 times higher than the non-EM group for getting revoked due to a technical violation may suggest that the EM group is more likely to fail their supervision conditions, or it could be due to the increased surveillance and/or additional conditions placed on them. This warranted a closer examination of the violation type for each revocation, which revealed that among both groups the most common reason for revocation was substance abuse, with 33 percent (n=3) of the non-EM and 65 percent (n=23) of the EM group getting revoked for this violation. Among the EM group, another 20 percent (n=7) was revoked for device issues. This violation type is exclusive to the EM group, since the non-EM group do not have any device requirements. Another violation type exclusive to the EM group was leaving the house without permission, which occurred in 9 percent (n=3) of the EM violation cases. A total of 56 percent (n=5) of the non-EM group and 3 percent (n =1) of the EM group were revoked for failing to check-in with their pretrial officer. Finally, only 1 defendant in each group was revoked for victim contact. See Table 4 (next page) for the violation types for each group.

While significant differences were found between the EM and non-EM groups, an additional set of within-group analyses was conducted to see if there were differences between the types of technology used for the EM group. The results found that there were no statistically significant differences between those on GPS versus RAM for any of the outcomes. Another set of analysis was also conducted to examine whether there were any differences among the various offender types (violent, property, drug, sex, or other) in

TABLE 3
Survival Analysis Results

Measure	Non-EM (Control) n = 208	EM (Treatment) n = 208	Hazard Ratio Exp(B)	P Value
Revocation for technical violation	4.32% (n = 9)	16.82% (n = 35)	3.39	.001 **
Revocation for new arrest	4.32% (n = 9)	4.80% (n = 10)	1.01	.982
Revocation for failure to appear (FTA)	22.59% (n = 47)	8.17% (n = 17)	.341	.000 ***

Note: Sample size Non-EM group =208; EM group = 208. * p < .05; ** p < .01; *** p < .001

TABLE 4
Technical Violation Type for EM versus Non-EM Groups

Violation Type	Non-EM Group (n = 9)	EM Group (n = 35)
Substance abuse	33% (n = 3)	65% (n = 23)
Device issues	Not applicable	20% (n = 7)
Failure to check-in	56% (n = 5)	3% (n = 1)
Leave house without permission	Not applicable	9% (n = 3)
Victim contact	11% (n = 1)	3% (n = 1)

the EM group. It was found that drug defendants placed on EM had a 2.73 times higher hazard rate of getting revoked for a technical violation compared to other offense types. This corresponds with the finding above that substance abuse was the most common reason for a technical violation. No significant difference was found among offense types for new arrests. Finally, the only significant difference among offense types for the likelihood of getting revoked for a FTA was that property defendants had a hazard rate that was 3.44 times higher compared to other offense types.

Discussion and Future Work

When considering pretrial release options such as EM, it is important to make sure that they are used in the most effective and least restrictive manner possible. The Pretrial Justice Institute cautions correctional agencies to consider all of the potential harms of being placed on EM to ensure that these devices do not pose similar negative impacts that have been found to result from incarceration (Pretrial Justice Institute, 2014). Pretrial release may be able to cut down on costs and reduce the collateral consequences of incarceration; however, the challenge or risk of using pretrial release is that defendants may not show up to court or they may reoffend during their release. EM as an added condition of pretrial release should only be used when it can ensure court appearance and does not compromise public safety.

The use of EM within the Office of Pretrial Services in the County of Santa Clara is conducted in a judicious manner. During the time period examined in this study, the number of defendants placed on the EMP program represented 3.6 percent in 2014 and 7 percent in 2015 of the total pretrial cases during that year. The current study found that within the county, the use of EM increased the likelihood of showing up to court, and the EM group did not pose any higher or lower public safety risk by being released. Failing to appear in court is problematic, since it poses additional costs for both the courts and the defendant. Not showing up for a court proceeding can result in a warrant being issued for the defendant's arrest and/or the defendant's bail being increased. The current finding suggests that the use of EM reduces FTA rates and could also imply that if defendants are not being tracked prior to court, they are less likely to show up. From the perspective of cost savings and public safety, these results indicate that the use of EM could have significant positive impacts for pretrial agencies. This is supported by previous cost-benefit analyses conducted on the use of EM, which have found that the use of EM can reduce crime, cut agency costs, and result in positive societal benefits and savings (Roman et al., 2012; WSIPP 2017a; WSIPP 2017b; Yeh, 2010). The 2017 meta-analysis conducted by Belur et al. also reported that EM was found to have a positive impact when used as an alternative to incarceration.

Yet despite EM's being a potentially cost-effective alternative to incarceration, agencies should also take care to avoid putting the burden of paying for the EM devices on the defendant, which, similar to money bonds, may discriminate based on socio-economic status (Pretrial Justice Institute, 2014). This may also lead to potential technical violations and revocations back to jail for their inability to pay (Markowitz, 2015). Throughout the country in states like Georgia, Arkansas, South Carolina, Colorado, Washington, and Pennsylvania, defendants are placed on EM as a condition of pretrial release and required to pay for their monitoring device. Arguing that the use of EM could be promoting a modern-day debtors' prison where indigent defendants are imprisoned for failing to pay legal fees they cannot afford, critics point to concerns about making individuals pay for their supervision when they have not even been convicted of a crime yet (ACLU, 2010; Markowitz, 2015). It should be noted that defendants in Santa Clara County are not required to pay for their EM devices, and thus no technical violation or revocation was associated with the lack of payment. Additionally, in early 2018 a landmark legal case in the California appellate court involving 64-year old San Francisco resident Kenneth Humphrey set forth a ruling that now requires California judges to consider a defendant's ability to pay when setting bail and to consider non-monetary alternatives to incarceration (Egelko & Sernoffsky, 2018).

The study also found more than a three-fold increase in the likelihood of getting revoked back to jail for a technical violation. As discussed above, the total number of violations in the current study is small, representing about 17 percent (n=35) in the EM group and just over 4 percent (n=9) in the non-EM group over a span of two and a half years; however, the difference between the two groups is still statistically significant. This substantial difference in the increased likelihood of technical violations among defendants on EM and the fact that there were violations associated with being on EM itself also sheds light on the very important consideration of net widening. Net widening describes a process that brings more individuals into the correctional system rather than being used to decrease or to supplement existing sanctions (Mainprize, 1992). It is a commonly reported concern of electronic monitoring, with previous studies suggesting that individuals placed on EM could be effectively supervised with less restrictive conditions than EM (Bonta, Wallace-Caprettta & Rooney, 2000; Mainprize, 1992; Nellis, 2014). An examination of whether EM has

a net-widening effect in the pretrial context, however, is limited. As such, this concern that defendants could be pulled deeper into the legal system due to their being subject to more conditions of supervision as a result of being placed on EM warrants further examination.

The present study has some limitations. While statistical matching procedures were used and minimized the selection bias, some potential key variables that may be related to the effectiveness of EM use were not included. These include variables such as employment history, involvement in and quality of a marital relationship, whether the defendant has children to care for, mental health information, and judges' sentencing preferences. Future studies should look to examine such variables to assess their impact on the use of EM. The study also focused on a single jurisdiction in the United States, so it may be hard to generalize the findings to other jurisdictions or countries given the variation in the use and implementation of EM programs. Also of note and a potentially important area for future research is to examine and understand if there are any differences in the uses and experiences of being placed on EM during pretrial release for different demographic groups. The current sample showed that Hispanics made up approximately 50 percent of the sample, and yet they only make up 25.6 percent of Santa Clara County's population. Similarly, Blacks made up 12 percent of the current sample but only represent 2.8 percent of the county population (U.S. Census, 2017). Research spanning decades has shed light on the disturbing disproportionality and staggering disparity of the criminal justice system. Ethnic and racial minority groups are more likely to be over-policed, under-protected, arrested, and incarcerated (Goodey, 2006; Steffensmeier et al., 1998; Thomas, 2013). In light of these disparities, the rising use of EM within the pretrial stage and the limited research on the topic, it is essential that future studies analyze any differences in experiences across various groups.

The evidence on the effectiveness of EM for pretrial use is still limited, and continued examination of how to best use the technology is needed. The use of EM technologies in Santa Clara County provides an example of a jurisdiction where the use of these tools is based on proper screening through empirically-derived pretrial risk assessment tools to decide pretrial release conditions and examining the appropriateness for each individual prior to being placed on EM. Since the time period of this study, the number of defendants placed on the EMP program has increased to almost 23 percent in 2018; however, this is in part due to the Humphrey's decision discussed above. The agency still remains vigilant in its assessment for the use of EM and monitoring for net-widening and continues to provide the program at no cost to defendants. Previous studies indicate that pretrial detention significantly weakens the defendants' bargaining positions during plea negotiations, increases the probability of being sentenced, and increases the sentence length if convicted (Dobbie, Goldin, & Yang, 2017; Phillips, 2008). Electronic monitoring devices may pose an alternative to pretrial detention, especially if a higher level of supervision is required upon release. However, as noted above, there are also some potential negative impacts if EM is not used judiciously. Based on the findings of the current study, it appears that the use of EM may have some positive impacts such as increasing the likelihood of returning to court. However, the increased likelihood of technical violations suggests that future research should continue to expand on these findings to determine the best use of EM within the pretrial context that protects defendants from the collateral consequences of incarceration and instead increases their likelihood of success during pretrial release.

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