The Effect of Digital Technology on Prisoner Behavior and Reoffending: A Natural Stepped Wedge Design

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Abstract

Objectives

Although prisons aspire to rehabilitate offenders, they fail to prepare prisoners for release into our modern digitally sophisticated society. The objectives of the current study were to assess the impact of digital technology on the culture of prisons, and on prisoners' ability to self-manage their behavior and reoffending.

Method

Using a natural stepped-wedge design, thirteen prisons in the UK were examined that had installed self-service technology over a period of seven years. A longitudinal multi-level model was used to analyze frequencies of disciplinary proceedings within and between the prisons before and after installation. Reoffending was examined in comparison with a control sample. Quantitative results were supported by a prisoner survey and usage data.

Results

Prison disciplinary offenses were significantly reduced over a two-year period, and reoffending in the first year after release was reduced by 5.36% compared to a 0.78% reduction in comparison prisons. The prisoner survey and usage data suggested that prisoners felt much more in control of their lives in prison and much more confident in coping with technology in the outside world.

Conclusions

The changes created by the introduction of digital technology offer the opportunity to make prisons more efficient for staff, and places of improved learning and rehabilitation for prisoners, contributing to a safer society. This study offers an important contribution to the field of corrections, providing the first quantitative assessment of the effect of prisoner self-service technology on prisoner behavior and reoffending.

We have learned much in recent decades about how to rehabilitate offenders. We have discovered that offending behavior programs targeting "risk" and "need" with cognitive behavioral interventions can significantly reduce reoffending of prisoners and offenders in the community (Bonta and Andrews, 2017; Andrews et al., 1990; Lipsey et al., 2007; Lipsey and Wilson, 1998). These principles have subsequently been incorporated into structured community supervision with successful outcomes in reducing reoffending in comparison with traditional supervision methods (Bonta et al., 2008; Lowenkamp et al., 2014; Pearson et al., 2011; Robinson et al., 2012; Smith et al., 2012; Taxman, 2008). More recently, attempts have been made to enhance these approaches with methods to encourage desistance from crime through building on positive characteristics of offenders (McNeil and Weaver, 2010; Ward, 2010). However, so far, these approaches have not demonstrated an improvement on the reduced levels of reoffending already achieved (Andrews et al., 2011; Netto et al., 2014), particularly among those serving short prison sentences (Ministry of Justice, 2011).

There are however opportunities to improve rehabilitation in prisons by using digital teaching techniques to expand our capacity to deliver evidence-based interventions. Our school children are experts in digital technology, while our prisoners "constitute one of the most impoverished groups in the digital age" (Jewkes and Reisdorf, 2016, p. 1). Their digital exclusion is exacerbated by refusing them the opportunity to acquire and use the basic skills they need to function successfully in modern society. Although not all prisoners lack digital skills, it is argued that there is a growing "digital divide" in society, with many

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prisoners finding themselves at the extreme end of this divide (Champion and Edgar, 2013, p. iii). In this paper we evaluate the use of digital technology in prisons to assess whether access to this technology can improve prisoner behaviour inside and outside of prison. We argue that the technology can support offender rehabilitation by encouraging self-responsibility and preparedness for release, thereby reducing reoffending.

Reforming Prisons to Assist Offender Rehabilitation

Recently governments with high rates of imprisonment have recognized that prisons are an expensive way not to rehabilitate people, and that more use should be made while prisoners are in our care to rehabilitate persistent offenders. In a number of US jurisdictions it has become clear that the political climate is moving away from punishment-based policies. The US State of California, for example, has taken decisive action in reducing its prison population by one-third, with radical plans for offenders to be managed in their local communities (Petersilia, 2016). Similarly, in England and Wales, Ministers have spoken emphatically about the need for change so that prisons may become places of learning and rehabilitation rather than outdated human warehouses. Prison Governors will be given "unprecedented freedom" to introduce reforms and operational autonomy to introduce opportunities to promote rehabilitation, and the Prime Minister announced that six reform prisons would be created to pilot this increased autonomy (Cabinet Office, 2016).

Prisoner rehabilitation and re-entry to the community plays a large part in plans to make communities safer in both the US and UK with attention being given to encouraging activities that will better prepare offenders for reentry and

improve links between prison and the community before release (Cabinet Office, 2016; Office of the Attorney General, 2016). However those who have been detained for many years will not recognize the modern world they will be released into, having a complete lack of familiarity with the electronic devices they will need to understand to function. Although those more recently imprisoned will be more familiar with digital communication, we are nevertheless aggravating their disadvantage by depriving them of technology as a means of preparing for their release. According to Her Majesty's Chief Inspector of Prisons in 2013, "prisons [are] in a pre-internet dark age: inefficient, wasteful and leaving prisoners woefully prepared for the real world they will face on release. I have not met one prison professional who does not think drastic change is needed." (Champion and Edgar, 2013, p. iii).

The introduction of digital technology to prisons can assist rehabilitation in two main ways discussed below: these are by changing the prison culture to be more supportive of rehabilitation, and by providing prisoners with the skills and means to prepare effectively for their release.

Changing the prison culture.

To really achieve effective rehabilitation, efforts made must be supported by the prison culture. Officers are known to suffer stress if there is a clash between the culture and how they are being asked to perform their roles (Lambert et al., 2011; Viglione et al., 2017). Incongruence may also impact on prisoners undertaking rehabilitation programs in a classroom, but then returning to a hostile and inhospitable prison environment at the end of the session (Mann et

al., 2013). Mann and colleagues found that prisoners thought attending treatment would harm their social status in the prison.

A growing body of research supports the view that prisons, rather than being an effective deterrent to crime, are often in themselves criminogenic (Agnew, 2006; Cid, 2009; Listwan et al., 2013; Mazerolle and Piquero, 1998; Nagin et al., 2009; Sherman, 1993). Listwan et al.'s research tests Agnew's (2006) general strain theory (GST) which proposes that events and conditions that are physically or psychologically distressing to individuals increase the likelihood of criminal behavior. Events included in categories of strain are similar to stressors prevalent in most prisons, such as perceived unfairness and lack of control. These are said to lead to negative emotional states, such as anger and frustration, which can lead to violent and criminal behavior. Listwan et al. (2013) propose that, not only do the pains of imprisonment promote a negative response to current events in prison, but also that certain types of strain appear to increase the likelihood of reimprisonment. The kinds of strain predicted to have an association with reoffending were: "negative impact by other inmates, particularly verbal and physical abuse; negative treatment by staff; negative prison environment, notably the perceived level of violence in the prison; and anticipated strains after release, especially economic and housing strains" (Listwan et al., 2013, pp. 150-151). Results showed that a negative prison environment and negative relations with other inmates were associated with a higher probability of reimprisonment. Surprisingly, negative relationships with correctional officers did not appear to affect reoffending, although impact within the prison was not considered, as Listwan et al.'s study was based on community adjustment data and self-report from ex-prisoners. The GST might suggest

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however that both a negative prison environment and negative treatment by staff would impact on misconducts.

Prisons are also inefficient, as attested to by HM Inspector of Prisons (see above), which can also lead to frustration. In most UK prisons today prisoners, if they have a request, have to speak to a prison officer or write the request on a piece of paper. This piece of paper is then transferred to the relevant department, is dealt with by hand, and returned to the prisoner with an answer (Author reference removed for review). As one prisoner stated to the authors "We're treated like children. Everything is done for us. Come on – we're adults". These paper-based transactions could take days, and depend on the quantity of paperwork the officer is required to handle that day. In the case of buying items from the prison shop, this could amount to more than a thousand pieces of paper being handled by officers during one week on this one function. This process is inevitably subject to delay and human error, resulting in much frustration. Prisoners and officers both recognize such incidents as a major source of dispute between them; often prisoners equate the speed of response with the degree to which they are treated with respect (Hulley et al., 2012). This can become a major source of tension and is far removed from preparing the prisoners to take responsibility for their lives on release. The impact of these processes are in line with the main strains of perceived lack of fairness and lack of control, identified in GST (Agnew, 2006).

Disputes over paper-based systems can be a major contributor to adjudications, the main disciplinary procedure in prisons for misconducts. Adjudications have been recognized as a major predictor of reoffending (Cochran et al., 2014; French and Gendreau, 2006; Heil et al., 2009), so the ability

to reduce adjudications by removing its causes could be a valuable contributor to rehabilitation. Giving prisoners responsibility for managing basic tasks for themselves would decrease the blame culture that exists, and allow prisoners to feel more in control of their lives, so removing one of the sources of perceived unfairness.

There is increasing interest in the US, UK, Europe, and in Australia in normalizing the prison environment by bringing prisons more in line with modern society through digital technology and use of tablet computers in prisons (Thompson, 2014; Tran, 2014). Conferences are also being organized to extend knowledge of what might be achieved through introducing digital self-service devices so that prisoners have more control over their lives (International Corrections and Prisons Association - ICPA, 2017).

In the UK some prisons have installed "self-service kiosks" on prison wings, similar to those found in superstores, where prisoners can independently take responsibility for many of their own requirements. The prisoner can, for example, order toiletries and small items from the prison shop by simply choosing from a list on a kiosk; subsequently the cost of purchases are automatically calculated, deducted from the prisoner's private account, and a receipt is provided and the products are delivered. Other functions are described below (see Theory of Change for Prisoners). These functions are similar to the kinds of digital self-service in the community, and offer the opportunity to practice the skills required to prepare for release. Prisoners can therefore gain experience of using the technology in the security of the prison environment, while at the same time increasing their autonomy and personal skills.

The benefits for officers, as well as prisoners, are also apparent. These include relieving officers from mundane administrative tasks to allow them to become involved in rehabilitation activities and maintaining safe and secure prisons (Author reference removed for review).

The use of prisoner self-service (PSS) technology is not widespread across the UK Prison Service. Although intuitively the benefits appear evident, we have heard strongly-held views that handing over such control to prisoners will have a deleterious effect on the relationships between officers and prisoners. This reluctance to yield control may be an artefact of "a more militaristic approach" to dealing with prisoners, as observed for example in a comparison of Dutch and English prisons (Dirkzwager and Kruttschnitt, 2012, p. 409). The alternative view from prisoners and officers is that the use of kiosks actually improves the relationship between them. Researchers and policy-makers should therefore not be deterred from embracing new technology because of fears of changing officer/prisoner relationships as this could provide an opportunity for genuine culture change in prisons.

Encouraging prisoner self-directed rehabilitation.

Wolff et al. (2012) examined readiness for release in prisons and concluded that those who had been in prison the longest were the least prepared for release, although this conclusion may be open to dispute (Tiedt and Sabol, 2015). Wolff et al. recognized that prisoners require education, financial assistance, job training, employment assistance and community living skills, together with the self-management skills associated with their offense-related problems. Whilst acknowledging the importance of these training needs, few studies so far have

identified the importance of acquiring skills in the use of digital technology to achieve these goals, nor in attempting to disconnect the relationship between digital and social exclusion (Helsper and Eynon, 2013).

The disadvantage to prisoners created by lack of digital facilities and hence limited acquisition of skills, has been recognized (Jewkes and Reisdorf, 2016; Knight, 2015). However there has so far been no published empirical evaluation of the impact on prisoners of teaching digital skills and using them to facilitate prisoner rehabilitation. A number of prison studies have examined whether Information Technology has been an aid to education but often the research designs have been weak. One rigorous experimental study evaluated the "Efficacy of a computer-assisted instruction program in a prison setting" (Batchelder and Rachal, 2000). The authors found no statistically significant additional impact from computer-assistance over that of traditional tuition. This may be because many prisoners have had discouraging early experiences of class-room based tuition which dissuades them from taking part in adult education. However, if use of the computer is in the prisoner's interests, such as completing a daily activity on their own behalf, or organizing a visit with their family, then there may be greater motivation to learn the skills.

This proposition appears to be supported in research by King et al. (2017), who tested in a randomized controlled trial the difference between prisoners completing psychological assessments on tablet computers and those using paper and pencil. Although there was no difference in content between the two methods of response, King et al. found prisoners had a preference for using the tablet computer and subsequently adopted a more constructive attitude to the correctional institution after using the technology, compared to the attitude of

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those using the paper and pencil method. If a similar response was found using technology for managing one's own basic requirements in prison, this would be a valuable indicator as to how we may motivate prisoners to learn new skills related to rehabilitation. A wider participant pool for rehabilitation might therefore be accessible through the use of digital technology.

Many of the skills identified by Wolff and colleagues (2012), and Andrews and Bonta (1995) in the Level of Service Inventory-Revised, as being important criminogenic needs to be addressed in rehabilitation, could be assisted by the use of technology in prison. This could expand the range of prisoners who can be encouraged to take advantage of the Risk – Need – Responsivity (RNR) principles. In the current study we do not expect digital technology in itself to be the active agent of change in addressing criminogenic needs, but could be the instrument that aids the translation of a well-designed intervention from that of a demonstration project to being part of regular practice reaching large numbers of offenders (Bourgon et al., 2009). This approach might also give more flexibility to take account of participant "responsivity", which has sometimes received less attention than other elements in the RNR model (Goggin and Gendreau, 2006). This has been highlighted as a potential problem in large scale roll-out studies which depend on a fixed program being delivered with little scope for adapting to individual learning needs/styles (Polaschek, 2012).

Theory of Change for Prisoners

Our proposition can be illustrated in a Theory of Change for Prisoners following implementation of Prisoner Self-Service (PSS) technology (Figure 1). PSS has the advantage, once installed, of having to be used by all prisoners in

order to access basic routine requirements such as ordering food, buying items

from the prison shop, checking financial account balance, and booking visits.

There are additional functions such as applying for education, a change of

employment, health care appointments, and to join a rehabilitation program.

These PSS functions may facilitate plans for release and allow the prisoner to

show interest in rehabilitation. Although the theoretical model has a standard

format, it offers flexibility to adapt to the individual, depending on the assessed

type and level of risk and need. King et al. (2017) have demonstrated that

psychometric assessments, such as the Risk Need Perception Survey developed

to appraise self- and evaluator–perceived criminogenic needs (King, 2016),

based on Bonta and Andrews' (2017) RNR model, can be successfully

administered by the use of tablet computers. Though these were not available in

the current study, variations on the technology provided may be considered in

the future.

[Figure 1 about here]

In Figure 1, the first stage shows implementation of the kiosks and in the

second stage the prisoner learns the skills and begins to use the system. The

third stage presents a selection of tasks that prisoners will be able perform for

themselves:

Direct contact with the Offender Supervisor (OS).

Direct contact with the OS will allow the prisoner to initiate written contact

in order to make appointments, discuss rehabilitation plans, offense-related

programs, employment prospects, accommodation, or family issues. This allows

a focus on purposeful activity. Mann et al. (2013) have noted that many

offenders are deterred from seeking help when they have to make the request through a prison officer, hence direct contact may help to overcome this.

Access to Programs/Education/Support.

Access to programs will facilitate changes in criminogenic needs, as identified by Bonta and Andrews (2017).

Self-responsibility/ Reduced dependency on officers.

The value of being in control of basic activities is supported in the GST (Agnew, 2006) as alleviating some of the strains on prisoners, which can lead to criminal activity. The theoretical model shows a pathway towards reducing adjudications.

Easier contact with family and friends.

This has been emphasized by Lösel et al. (2012) as being extremely important to prisoners and their families in a longitudinal study of imprisoned fathers and their families. Positive resettlement, which included desistance from crime, was associated with a high quality of family relationships, good communication between father and family during his imprisonment, and high frequency of contact in prison.

Improved attitudes and prospects for accommodation and employment

Stage four shows the potential positive impact on prisoner thinking, feeling and behavior, following the opportunities presented in stage three. Consistent with the GST (Agnew, 2006), negative attitudes dissipate due to reduced feelings of injustice and ill-treatment. This would aid prisoners in making contact with an external supervisor, finding employment on release, finding accommodation, and improving relationships with family, thereby reducing strains and improving prisoner well-being and mental health (Listwan et al., 2013).

Final Outcome Measure.

Stages 5, 6, and 7 are the outcome measures linked to reducing dynamic risk. At the final stage it is anticipated that the changed behavior in the prison and reductions in risk of some offenders may impact on the actual rate of reoffending following release (French and Gendreau, 2006).

It is proposed therefore that the implementation of the technology, interacting with the opportunities it presents for more purposeful activities, is likely to impact on prisoners' attitudes and behavior. The improvement in prison behavior will impact on adjudications, which is a positive predictor of reduced reoffending (Cochran et al., 2014; French and Gendreau, 2006; Heil et al., 2009). At the same time there is likely to be a positive impact on rehabilitation with improved family relationships (Lösel et al., 2012) and an increase in successful offending behavior program completions (Bonta and Andrews, 2017). The model allows for individual tailoring depending on the individual prisoner's risk, criminogenic needs and treatment responsivity. It is anticipated that officers will be relieved of many of the mundane daily paper-based tasks involved in meeting the basic requirements of prisoners, and hence will have more time to assist in encouraging individual prisoners in developing their problem-solving skills (Champion and Edgar, 2013; Author reference removed for review).

The Current Study

Only a small number of mainly private prisons have so far installed prisoner self-service (PSS) technology. The current study was set up to rigorously

examine the psychological, social and rehabilitative impact of PSS in those prisons that had adopted it.

The main study was preceded by a process evaluation in a prison that was about to install PSS and this contributed to the Theory of Change described above (Author reference removed for review). The process evaluation facilitated the identification of suitable measures to empirically test the impact of PSS. For statistical reasons we selected three representative performance measures to examine impact on the main prison priorities of providing 'Safe, Secure and Decent Prisons', 'Prisoner Rehabilitation", and a 'Reduction in Reoffending'. The measures would be supported by qualitative information and usage data.

In discussion groups we discovered that both officers and prisoners thought that the outdated paper-based systems actually contributed to hostility between them. Some prisoners thought that officers did not take their applications seriously, and officers were aware that they were often accused of being responsible for delays in the system, or even deliberately failing to process an application. In addition, PSS encouraged prisoners to take responsibility for their own activities in prison. Prison adjudications are the main disciplinary proceedings in UK prisons for a range of behaviors from violence to disobeying an order. It was hypothesized that:

A.   adjudications would be statistically significantly reduced as a consequence of removing sources of tension between prison officers and prisoners, and giving prisoners more responsibility for their actions.

Since prisoners were now no longer dependent on officers to apply for attendance at education and rehabilitation programs and to make contact with

their offender supervisor, it was considered that they would be more likely to be motivated to enroll for these programs (Mann et al., 2013),   It was therefore hypothesized that:

B.   The completion rates of offending behavior programs would

significantly increase.

According to research evidence (Bonta and Andrews, 2017) if attitudes and behavior in prison improved (Hypothesis A), and more prisoners were addressing the dynamic risk factors associated with their offense, it was hypothesized that:

C.   Reoffending after release would be reduced among prisoners who

had experienced PSS when compared to those who had not.

Method

Data Sample

Prisoner self-service (PSS) kiosks, located on prison landings, exist in a small proportion of prisons in England, Scotland and Wales, and 13 prisons were chosen for the study as being those that had introduced PSS prior to 2014. This date allowed at least six months prisoner experience of the kiosk system in all prisons and at least 12 months follow-up of proved reoffending (reconvictions in a court) in the community after release. This sample was drawn from establishments covering a range of categories of prison, including public and private sector, local, training and high security. Hence these represented differences in jurisdiction, prison types, and commercial operating models. Identities of prison sites are anonymized in this paper as agreed in the ethical approval process and in accordance with non-disclosure agreements.

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Comparison groups of similar category prisons without PSS were used to compare trends in the rate of reoffending nationally. The comparison groups were based on "family'" groupings used by the then National Offender Management Service (NOMS) to categorize similar types of prisons in terms of population, size, and risk (see Ministry of Justice, 2015[1]). To avoid sample overlap prisons identified as PSS prisons were removed from the comparison group data.

Design

As most of the prisons that had installed kiosks were private prisons it was not possible to use public prisons without kiosks as a comparison group for interim prison outcome measures. There are numerous cultural and operational differences between public and private prisons, which may make comparisons between them inappropriate (Hulley et al., 2012). We therefore adapted the randomized controlled "stepped wedge" design of Hussey and Hughes (2007), to enable the most rigorous method available to examine retrospective data, equating to an observational quasi-experiment. A stepped wedge randomized controlled trial (RCT) is a type of cross-over design that allows prisons to begin as no-intervention controls, and at random intervals to cross over from the control group to the intervention group. Thus at the end of the trial all prisons will have crossed over to the intervention group.

The stepped wedge design in Figure 2 shows no interventions in 2007, with a systematic introduction of the technology to prisons in subsequent years, resulting in all prisons receiving the technology by 2014. Hence, Figure 2 was able to take account of the dates when a prison received PSS and examine

monthly data from the prison during the time periods before and after the PSS

technology had been installed. As most of the prisons installed kiosks at

different times across a time period from 2007 to 2014 in a pseudo-random

fashion, if PSS was having an impact, one would expect to see a change in the

value of the relevant measure associated with the installation date in each

prison, but no change in the other prisons at those times. This would therefore

isolate an effect in each prison as being attributable to the PSS installation (a

within-prison comparison) when no change was occurring in the other prisons

(a between-prison comparison), so minimizing the possibility that the outcome

was due to some change other than the installation of PSS. This approach is

particularly powerful if one can compare the time series of those who are and

those who are not exposed to an intervention (Cleary et al., 2012).

[Figure 2 about here]

Measures

Selected outcome measures.

Although the Theory of Change for Prisoners (Figure 1) identified a number

of variables that might impact on prison behavior, from a statistical point of view

we chose to select a primary measure for each main prison priority (see Table 1).

[Table 1 about here]

Adjudications.

It was anticipated in the research design (Hypothesis A) that tensions

between prisoners and staff would be reduced following the introduction of PSS.

We therefore selected Adjudications as the most appropriate outcome measure

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for this change of process. Adjudications are the main disciplinary procedures used in prisons by Governors/Directors to consider cases of breaches of prison rules and to impose sanctions on behaviors ranging from minor acts such as disobeying an order to serious violent assaults. This outcome measure was recorded across all of the PSS prisons for a period of seven years on a monthly basis, regardless of the severity of the misconduct. Analysis of individual prisons was conducted using monthly data points collected over the full time periods before and after installation of PSS. The data for each prison installing PSS were compared in the analysis with data over the same time period in the other prisons when PSS was not being installed. All prison data were divided by the size of population in that prison at the end of each month to control for changes in the population. It was proposed that if a meaningful reduction in adjudications could be associated with the installation of PSS in each prison, this would be evidence that PSS was likely to be creating that impact, if no other major reason for the change was evident.

A sensitivity analysis was conducted post-hoc on the five prisons with the longest time periods pre- and post-PSS to examine whether those prisons with shorter time series might be over-influencing the outcome.

Offending Behavior Program (OBP) completions.

OBP completions were selected as a measure of rehabilitation. These were restricted to accredited Living Skills or Thinking Skills Programs as these tend to be run in most prisons and they are general offending programs and not offense-specific. The number of prisoners completing programs (OBP completions) was calculated as a proportion of the number of prisoners starting programs. This

measure was selected as a proxy for prisoner commitment to rehabilitation, and

OBP completions are recognized as an indicator of reduction in reoffending

(Lipsey et al., 2007) (Hypothesis B).

Longer-term outcome measure: Proved reoffending (reconviction in court).

Hypothesis C was based on the assumption that, if Hypotheses A and B were

achieved, as predicted by research, this would assist dynamic risk reduction,

leading to reduced reoffending (Bonta and Andrews, 2017; French and

Gendreau, 2006).

A proved re-offense is defined as any offense committed in a specific follow-

up period that leads to a court conviction or caution (including a further six

month waiting period to allow the offense to be proved in court). Proved

reoffending data for the PSS prisons were provided by Justice Statistics

Analytical Services (JSAS), Ministry of Justice, UK.

A six month period of releases before and after PSS installation was selected.

In order to be sure that a genuine effect of the technology was measured, a

period of six months was allowed without measurement immediately before and

after installation. This was to ensure that there was no contamination of results

caused by activities in preparation for PSS installation and, after PSS, to allow

time for equipment to work efficiently and prisoners to learn how to use the

equipment. Therefore the samples of releases were from -12 months to -6

months (pre-PSS) and +6 months to + 12 months (post-PSS). Prisoners released

during the pre- and post-PSS test phases were followed up for one year (plus 6

months to allow for court conviction) and their proved reoffending recorded.

Supporting information from a process evaluation.

Prisoner survey. A prisoner survey was conducted in a prison with newly installed PSS technology. The survey used the newly introduced wing kiosks as a means of completing the survey four weeks after installation. When a prisoner logged-on to the kiosk, the purpose of the survey and the confidentiality of responses were explained, and each prisoner was invited to complete the questionnaire. The questionnaire included questions relating to the impact of the technology on prisoners' lives, their relationship with prison officers and family and friends, and the likely effect on prisoners' lives after release.

Prisoner training to use the kiosks had been conducted by staff, with the aid of written instructions. Staff also trained prisoners already engaged in peer mentoring programs in the prison to assist those needing additional help in using the PSS kiosks. These peer mentors included 'listeners' trained to support prisoners at risk of self-harm and suicide, 'buddies' designated to help older prisoners, and educationally trained mentors who assist prisoners with reading difficulties. This staff/prisoner training process was thought likely to help improve relationships between staff and prisoners.

Usage of Self-Service Technology. Usage data were collected from a Main Wing in the process evaluation prison ($N_{prisoners}$ = 76) for one week at two time periods, i) one week after and ii) four weeks after installation of PSS. These data were collected remotely by the contractor.

Data Analysis

Given the nesting of time points of response within prisons and the need to account for variability at the prison level, the proposed statistical analysis of the interim outcome measures was Longitudinal Multi-level Modeling (LMM) (Singer and Willett, 2003). This 'mixed effects' method allows assessment of the immediate impact on, and change over time in, the selected outcome variables associated with implementation of an intervention. We were therefore able to estimate the impact of PSS on within-prison change in adjudications over time, controlling for individual prison populations, and trends over time using monthly data points and installation dates of PSS.

A key decision in the specification of mixed effects models is which explanatory variables are considered fixed or random effects. Specifying a random effect assumes that there is variation in the impact of that variable on the outcome, typically around a central value. It refers to the randomness in the probability model for the cluster-level coefficients. In our case the prisons were the clusters and we have assumed that these prisons represent a sample of the population of prisons that we could have observed.

However, if the impact of a given variable is interesting in itself, say comparing a specific prison to another prison, then these are referred to as fixed effects (to explore this distinction in depth see McCulloch et al., 2008; and Gelman and Hill, 2007). Here, we used a fixed effect for the PSS variable because we were interested in the impact of technology, so comparing before installation to after installation.

Unfortunately LMM was not suitable for use in analyzing Offending Behavior Program completions, due to missing data which reduced the sample size. In this case a non-parametric method, Wilcoxon signed-rank, was used.

The longer-term analysis of reoffending (reconviction in court) also required

a different method of analysis, as only two measures were collected for each

prison, pre- and post-PSS, i.e., proportion of releases who re-offended. A related

samples design was used, identifying a cohort of prisoners released six months

prior to and after self-service technology implementation in each of seven prison

sites,[2] with subsequent comparison of their one-year reoffending rates.[3] The

actual reoffending data were adjusted to take account of the level of risk of

prisoners based on historical data (i.e., predicted rate of reoffending in each

prison). The predicted reoffending rates were based on scores on the Offender

Group Reconviction Scale (OGRS: Howard et al., 2009)[4] averaged at a prison

level. To generate a proportional difference in reoffending between actual and

predicted, we used the formula: [*Actual – Predicted] / Actual.* A non-parametric

related samples test was used to compare the proportional differences in

reoffending pre- and post-PSS implementation at the prison level. To compare

with the national trend, we applied the JSAS formula in this case which compares

OGRS adjusted data with a baseline figure.[5] In the current study we have used as

baseline figures the prisoner data in the six months before installation of PSS,

and prisoner data in the same time periods in the control prisons.

Results

Adjudications

Table 2 below gives summary statistics for adjudications by prison site, pre-

and post-implementation of PSS averaged over the available time points.

However this does not reflect the slope of change across time data points, and

accounted for in the statistical analysis. Figure 3 shows the aggregated impact of

PSS across time, with time being centered on the date of implementation of PSS in each prison.

[Table 2 about here]

[Figure 3 about here]

The LMM analyzed population-adjusted adjudications from 10 prisons (due to missing data in three prisons), at available time points before and after PSS. This controlled for prison variability, time point data, and PSS installation date, and allowed for within- and between-prison analysis. As shown in Table 3 below we found a statistically significant reduction in the level of adjudications following installation of kiosks (estimates of fixed and random effects: γ=-.49 [95% CI: -.75,-.24], df=137.65, t=-3.79, p<.001). We can therefore be confident that this change in adjudications at the prison-level was associated with installation of the technology, as no other reason for the change affecting all prisons was evident. This reduction in adjudications continued for two years with frequency very slowly returning towards pre-installation levels at a rate of 4% per year (.0082 – .0048 = .0034 per month).

As some prisons had a smaller amount of either pre- or post-technology data, a sensitivity analysis was conducted on adjudications in five prisons which had the longest time periods of pre- and post-data. The analysis in this sub-sample appeared to confirm that the significant reduction in adjudications shown in 10 prisons (estimates of fixed and random effects: γ=-.54 [95% CI: -

.82,-.26], *df*=89.13, *t* = -3.84, *p*<.001) was not over-represented by those with

fewer pre- and post-PSS time data points.

[Table 3 about here]

Offending Behavior Program Completions

A large amount of program completion information was made available by

the National Offender Management Service (NOMS) from April 2010. However,

information on program 'starts' was only available from April 2009, which

limited the analysis of the impact of installations that occurred up to 2009. It

was therefore not possible to apply the full multi-level model analysis to these

data, so a simple non-parametric analysis was applied to investigate trends. The

mean proportion of completers to starters pre-PSS was 88.25% (*SD*=4.55) while

post-PSS the mean was 93.67% (*SD*=4.57). The difference in means was not

statistically significant (*t* = -1.96, *df*=4, *p*=.121). This is likely to be due to the

small sample size, however the average completion rate of 93.67% was near the

ceiling of possible performance. Although the sample size limits our confidence

in the results, Figure 4 shows that three out of five of the prisons with complete

data showed a sizeable increase in completions after PSS, which is encouraging

and positive. A larger sample would have allowed for a full analysis which would

have accounted for impact of PSS, the different types of prison, and the system-

wide changes over time affecting prisons with and without PSS.

[Figure 4 about here]

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Reoffending (Reconviction in Court)

Data were available for seven of the 13 prisons to calculate rate of reoffending. This missing data was due to some prisons having insufficient releases in the time period in question, or insufficient time to allow an 18 month follow-up after release. A Wilcoxon signed-ranks test indicated that before PSS in each of the prisons in the stepped wedge design, the proportion of actual to predicted offenses (*Mdn* = .09) was significantly higher than that after PSS installation (*Mdn* = .06). The actual rate was closer to or better than predicted by OGRS in six of the seven sites and the adjusted rate was lower after PSS than before PSS (z=2.03, *p*=.04, *r*=.54). The effect size of .54 shows that this represents a large change in outcomes between the pre- and post-PSS cohorts (Cohen, 1992).

Comparison with the national trend in reduced proved reoffending.

As we were aware that general prison proved reoffending was decreasing over the seven year time-period of our study, Justice Statistics Analytical Services (JSAS) also kindly provided us with control group data from the same "family group" of prisons, i.e., similar in terms of size, security category and type of offender, to those in our sample, so that we could compare the trend in prisons in general with those prisons with PSS.

[Figure 5 about here]

We therefore measured the PSS prison proved reoffending data and the control prison proved reoffending data over the same time periods, adjusted for

OGRS scores (see Figure 5). The difference between the baseline and post-PSS

proved reoffending for the comparison prisons was -0.78% and for the PSS

prisons it was -5.36%, demonstrating a greater reduction in the PSS prisons than

in similarly categorized prisons in the same time period.

It is evident that PSS prisons started at a higher actual rate of reoffending

pre-PSS than the control prisons. However the pre-PSS predicted rate (52.00%)

was not so much higher than that of the controls (48.83%). This resulted in a

larger decrease post-PSS with the PSS prisons ending with a smaller

proportional difference between their actual and predicted rate. This is in line

with the Risk principle that higher risk offenders have more scope for

improvement (Bonta and Andrews, 2017).

Prisoner survey

In one prison where PSS had been installed four weeks previously, we

conducted a prisoner survey. Out of a possible 1,389 prisoners, 743 (53%)

responded to the questionnaire. Although only one-half of the population

responded, this is more than double what can be expected and is considered to

be an exceptionally good response rate in a prisoner survey.[6] Below we divide

the prisoner survey questions and responses by two relevant prison priority

performance monitoring areas ('Safe, Decent and Secure Prisons', and 'Prisoner

Rehabilitation').

Of the 743 respondents, 93% thought the kiosks were "Easy" or "Very Easy"

to use, even though very little formal training was offered; and 7% thought the

kiosks were "Difficult" or "Very Difficult" to use. When asked 'Did you get

enough training/help to use the kiosks': 10% thought the training/help was about right; 80% of respondents said they had had no training/help or not much training/help; and 10% said they had "quite a bit" or "very much" training/help to use the kiosks.

Prisoner survey results: Safe, decent and secure prisons

Many of the staff, including the Director of the Prison where the survey was conducted, thought that the kiosks would give the prisoners more responsibility and control over their lives in prison. When asked "Have the kiosks given you more control over your life in prison?" 55% thought the kiosks had given them "more" or "much more" control over their lives in prison. This was the highest affirmatory response in the survey which suggests that the technology was having this impact. Meanwhile 36% thought the kiosks had made no difference; while 8% thought kiosks had given them "less" or "much less" control over their lives.

When prisoners were asked if PSS had affected their relationships with prison officers: 32% thought relationships were "better" or "much better" after PSS; 58% thought PSS had made no difference to relationships with officers; and 10% thought relationships were "worse" or "much worse".

Prisoner survey results: Prisoner rehabilitation.

Following introduction of the kiosks, 37% thought that relationships with family and friends were "better" or "much better"; 53% thought that PSS had made no difference to relationships with family and friends; and 10% thought relationships were "worse" or "much worse".

When asked if using the kiosks would give them more confidence to deal with IT enabled services in the outside world, 43% said PSS had given them "more" or "much more" confidence; 50% said PSS had made no difference to their confidence; and 7% said that PSS had made them "less" or "much less" confident.

Usage of the self-service functions.

[Table 4 about here]

There was a strong correlation in usage between Time 1 (after 1 week) and 2 (after 4 weeks) ($r = .92, p<.001$), with the most popular functions being Personal Account Balance, Prison shop, Phone Top-up, and Personal Timetable. Usage of all of these increased over the two time points. The only function to decrease was the Noticeboard which went down by 59%. By far the most used function was Personal Account Balance which accounted for 1,604 of the total number of log-ons of 1,785. The difference between Time 1 and Time 2 usage was not statistically significant. However when the negative Noticeboard usage was removed, there was a statistically significant result ($z=-2.524, p=.012, r=.89$) with a large effect size.

Discussion

This was the first quantitative evaluation of prisoner self-service (PSS) technology in UK prisons, and, to the authors' knowledge, the first

internationally. The evaluation has shown a statistically significant reduction in adjudications, the main disciplinary measure in UK prisons, between pre- and post-PSS installation; and a statistically significant reduction in proved reoffending (reconviction in court) with a large effect size, between groups of prisoners released before and after PSS installation. These results support Hypotheses A and C.

The study adopted a rigorous natural stepped wedge design, adapted from the Hussey and Hughes (2007) randomized controlled stepped wedge design. Adjudications were analyzed using a within prison and between prison longitudinal multi-level analysis.

The reoffending analysis controlled for the risk level of the offenders in the establishment using OGRS, a leading international risk measure in terms of its predictive validity (Yang et al., 2010). The analysis used the proportion of difference between actual reoffending and predicted reoffending as a measure of reduction in reoffending pre- and post-PSS installation. These findings could not be accounted for by national reductions in reoffending over the seven year study period, since a comparison with "family groups" of prisons, considered to be of the same level of security, type of prisoner, and risk as the PSS prisons, over the same time periods, showed a reduction in reoffending of -0.78%, as compared to the PSS prisons reduction of -5.36%.

These results imply that behavior in prison improved with introduction of PSS and this was reflected in improved behavior after release. This finding is in keeping with other research which has shown that adjudications by adult inmates are a reliable predictor of future reoffending (Cochran et al., 2014; French and Gendreau, 2006; Heil et al., 2009).

Offending Behavior Program (OBP) completions showed a non-statistically significant increase, thus failing to support Hypothesis B. This may be attributable to the amount of missing data for this variable, and should be measured more reliably in future prospective research. Although we were unable to demonstrate that the completion rate of OBPs increased significantly after PSS was introduced, this measure did increase from 88.25% to 93.67% which takes us near the ceiling of possible performance. The perceived stigmas experienced by prisoners in undertaking treatment are thought to affect their personal change process and can lead to treatment refusal (Mann et al., 2013). This improvement in OBP completions, although non-significant, indicates that the ability of prisoners to take personal responsibility for their applications to attend OBPs may overcome some of the resistance Mann et al. observed, and motivate prisoners to take advantage of these program opportunities. This needs to be tested in future research.

Changing the prison culture

It is important to reflect on the mechanism that achieved the statistically significant results in relation to adjudications and reoffending. Giving prisoners more control of their lives in prison by means of self-service technology may have made a contribution to changing the culture of the prison environment. We know that some sources of tension between prison officers and prisoners were removed, as prisoners were in control of their own requests rather than being dependent on officers. This development is not expected to fundamentally change the relationships between officers and prisoners which is a complex process, but it is removing a number of sources of frustration and disputes from

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the environment. This may also take away sources of perceived unfairness attributed as a major cause of anger and frustration for prisoners in general strain theory (Agnew, 2006). It is therefore proposed that introduction of self-service may have contributed to this reduction in perceived unfairness, hence significantly reducing the level of adjudications.

Evidence that taking control was happening came from the process evaluation conducted in one prison prior to the main evaluation (Author reference removed for review). When we examined the data on usage of functions among prisoners, we found that the most frequently used functions were those that demonstrated taking responsibility for managing finances, buying products from the shop, topping up their pay phones, and consulting their own individual timetable; i.e., taking control of their lives in prison. These are all functions that would have been slow and error-prone under the old paper-based system. The function for arranging visits from an availability timetable was not yet in operation at the time of the process evaluation, but it is anticipated that this would be another popular measure of 'taking control' in the prisons in the outcome study. The least used functions were those that were less instrumental such as reading the notice board, "frequently asked questions", and completing surveys.

A second source of evidence came from the prisoner survey. Despite the lack of enthusiasm for surveys coming from the usage data, the highest positive response was that 55% of prisoners who responded thought the kiosks gave them more control over their lives in prison, and 43% thought that the kiosks had given them much more confidence in dealing with IT enabled services in the modern world.

Although having more control over one's life in prison was not specifically tested in the Listwan et al. (2013) study on strain and inmate recidivism, "negative prison environment" was found to be associated with rearrest and reincarceration, and was linked to being in control, as one of the main hypothesized over-arching contributors to the strains of imprisonment, together with perceived injustice. This lends support to the view that the change in culture of the prison associated with PSS may have impacted positively upon prisoner attitudes to the prison and after release.

It is difficult to interpret why the positive effect on adjudications was only achieved over two years before returning to previous levels. The answer may lie in studies which have examined the duration of treatment effects over time. Prendergast et al. (2004), who conducted a five-year follow up in an RCT of drug offenders in a therapeutic community, found that the intervention effect size was reduced between year 1 and year 3 at follow up (Cohen's d = 0.31 reduced to 0.13) indicating a diminished impact. It was found however that, where there was further involvement in after-care in the intervention group, this was a significant predictor of lower levels of return to prison. It may therefore be that after-care is particularly important to maintain the initial changes due to the opportunities in accessing services afforded by prisoner self-service. However a contrary view is presented by Joliffe et al. (2013). A 10-year follow up of a High Intensity Training regime for young offenders with added educational training initially showed a statistically significant reduction in reoffending at two years, but the superiority over the control group diminished over time (at four years). However follow-up at 10 years showed that the cumulative number of convictions saved was 3.35 at 10 years compared to 1.35 at 2 years, and the

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benefit:cost ratio increased. Therefore a deterioration of impact in the short-term does not necessarily mean that the benefits will not be experienced over a longer time-period. This feature of benefits maintenance should be examined in future research.

Improving rehabilitation

A prison culture supportive of rehabilitation has also been recognized as contributing to effective behavior change (Mann et al., 2013; Lambert et al., 2011; Viglione et al., 2017) and ultimately reduction in reoffending (Listwan et al., 2013). The introduction of PSS may also have had a direct impact on activities relating to rehabilitation.   As a result of PSS, prisoners are becoming familiar with modern digital technology, while improving access to their own basic requirements. These skills will become useful when preparing for reentry to society. Although it is recognized there is a wide range of ability among prisoners to use digital technology, there are those who may never have been able to have access and learn to use the technology without a great deal of assistance. This is now made available, with regular daily practice, in the prison environment.   In the prisoner survey, 43% said they had increased confidence in dealing with digitally enabled services on release, which must be of assistance on reentry.

It is also possible that the effect of giving control to prisoners over some aspects of their lives in prison may have an impact on dynamic risk, providing them with more skills in coping in a non-criminal manner, resulting in a reduction in adjudications and reoffending (e.g., Bonta and Andrews, 2017) (Hypothesis C).

The results from this study support the Theory of Change (Figure 1) which also anticipated that the introduction of PSS could impact on adjudications and ultimately reoffending. The pathways from installation of PSS to the positive outcome measures were also to some extent supported. Prisoners were given the opportunity for more self-responsibility, and were no longer dependent on prison officers. Hence they were able to make direct contact with offender supervisors and have direct access to education and offending behavior programs. Contact with families was made easier by ability to organize their own visits from an availability timetable. Although we did not test directly the impact of these abilities on attitudes and well-being, we did ask for opinions via the survey and there did appear to be fewer frustrations, as illustrated in reduced adjudications. In the prisoner survey, 31% of prisoners thought relationships with officers were "better" or "much better", and 37% of the sample thought that relationships with family and friends were either "better" or "much better" after PSS. It seems likely that this improvement in relationships in general, and more confidence in life skills due to use of technology could have contributed to the outcome of non-criminal coping and reduced reoffending.

There appears to be an important link between a supportive prison culture and attempts to achieve rehabilitation with programs and supervision. In the case of technology it appears that the opportunity to self-manage within a secure and dependable environment instills a sense of autonomy in prisoners that is generally lacking when they are dependent on officers for the most menial daily tasks (Dirkzwager and Kruttschnitt, 2012). If a prison's culture and fitness for purpose are able to combine to form a rehabilitative climate, this may motivate

and encourage the vital "responsivity" factor (Birgden, 2004), which is an important element of the RNR model.

Of course, no initiative will help all offenders and there will be a minority that do not make the most of self-service, or who attempt to use it for anti-social purposes. This study, however, provides optimism for the effects of this technology in supporting rehabilitation.

Limitations of the data.

The current study was not without its limitations. We did not have data to track individual prisoners, and so the focus of the study was on the effect of Prisoner Self-Service at the prison level. The promising results of the current study raise the importance of testing the technology on individual prisoners' behavior. Second, collecting historical data over a period of seven years is subject to errors and missing data. Adjudications were however one of the most robust measures and hence many of the prisons were included. The number of prisons in the reoffending analysis was reduced to seven, as exclusions had to be made where small numbers of offenders were released and where there was insufficient time to follow up reoffending for a year. Despite the small numbers the effect size was large, due to the consistent positive impact, which we attribute to the prisoners' making use of the self-service technology, and taking more control over their lives in prison.

The measure of prisoner attitudes via the survey of prisoners in one establishment also lacked data as all possible participants did not complete the questionnaire. The percentage that did was however substantial for a prisoner population. There is no means of knowing if those that declined to complete the

survey had similar views to participants. The level of responding, 53%, is
nevertheless high in a prisoner context, and may be attributable to the ease of
access, completion and return, due to the PSS kiosks. This is encouraging for
future surveys in prisons with self-service technology.

Implications

The introduction of digital technology to prisons is in its infancy, and there is
much potential for development. The technology is likely to bring improved
efficiencies by automating time-consuming administrative tasks, and releasing
officers to be more involved in making prisons safer by improved visibility on
the wings, and aiding prisoner rehabilitation. This is likely to have a positive
impact on staff well-being.

Prisoners have adapted well to using self-service technology. Although it has
proved beneficial, the range of applications is limited due to provision via wing-
based kiosks, so restricting privacy and usage. Consideration is being given to
the use of tablet computers which would allow more scope for educational
features, personal assessments for example of risk, need and responsivity, such
as the Risk Need Perception Survey (King, 2016), and appropriate interactive
interventions. The current study also indicates the importance of self-service
technology operating within a rehabilitative prison climate and linking with
external probation supervision where prisoners' motivation to change is
supported with aftercare.

Given the importance highlighted in research of addressing the needs of
prisoners on release (Bonta and Andrews, 2017; Wolff et al., 2012) self-service
technology presents an opportunity for facilitating reentry preparation, and
promoting offender rehabilitation on a prison-wide scale. With the aid of self-

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service technology this process could reach a wider participant pool, not just in selected group programs but across the prison in many aspects of prison life. The digital environment can assist the real-time acquisition of life-skills, such as finance management, managing relationships within the prison, developing skills to aid employment on release, and strengthening family ties. In the process evaluation, officers had noticed a distinctly more positive problem-solving approach from prisoners, when they had more access to information and control of outcomes.

The programs and activities in prison still need to adhere to the RNR principles by matching interventions to levels of risk, identifying and addressing criminogenic needs, and responding to the learning style of the prisoner. However, within this framework PSS provides the opportunity to develop self-responsibility in coping more effectively with prison life and maintaining purposeful pro-social activities and relationships in preparation for release. This approach could be facilitated by ensuring that the time saved by relieving prison officers of the laborious basic tasks of looking after prisoners is channeled into supporting prisoners in taking advantage of the opportunities for self-responsibility for their own rehabilitation.

Conclusion

The present study offers an important contribution to the field of corrections in providing the first assessment of the effect of prison digital technology on prison behavior and reoffending. Although there were some effects of missing data, this study can be regarded as a positive indication of the likely effect of technology on the lives of prisoners, officers and the community into which

prisoners will be released. Our study demonstrated that prison behavior was significantly improved, and reoffending in the community was significantly reduced. Supporting information from usage data and a prisoner survey showed that the interaction with the technology produced a feeling of worth and personal control. This suggests that by introducing prisoners to modern technology it can transform their lives from dependency to self-responsibility, where they can learn new ways of behaving in a supportive rather than a punitive environment. As for staff, they are released from mundane administrative tasks, offering the opportunity to undertake a more fulfilling role of assisting prisoners to be involved in purposeful activities. It is rare for a change in a prison regime to be welcomed by both prisoners and prison officers, resulting in a positive outcome. Prisoners have shown themselves to be receptive to taking responsibility using modern technology when they recognize the benefits to themselves. We should take the opportunity to channel this enthusiasm into reform and rehabilitation when it is presented.

Endnotes

1. Available from https://www.gov.uk/government/statistics/proven-reoffending-statistics-july-2012-to-june-2013

2. One year reoffending data for seven of the prisons were provided by Justice Statistics Analytical Services (JSAS) – some prisons were excluded due to missing data.

3. This analysis differs from that used by JSAS, who compare full calendar year data against a selected baseline year, whereas data in the current study were taken from a selected subset to fit the stepped wedge design, centered on PSS installation.

4. The Offender Group Reconviction Scale (OGRS) is a predictor of reoffending based on static risk factors – age, gender and criminal history.

5. $r_x^1 = r_x - (g_x - G)$. Where r_x^1 = adjusted reoffending rate in period x, r_x = original reoffending rate in period x, g_x = OGRS in period x, and G = OGRS in the baseline year (2011).

6. An example of a typical prison survey response rate is 4% to 25% across eight prisons. e.g., *Published in Third Sector Research Centre Working Paper 61, 2011. A report on 'Offender engagement with third sector organisations: a national prison-based survey'.*

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Tables and Figures

Table 1

Outcome Measures Corresponding to Prison Priorities in England and Wales

Prison Priorities	Outcome Measure	
	Interim	Longer-term
Safe, Decent and Secure Prisons	- Adjudications	
		Proved
		Re-offending
Prisoner Rehabilitation	- OBP completions	
Supporting Evidence	Prison Survey	
	Usage of	
	Functions	

Note. OBP = Offending Behavior Program

Table 2

Site Statistics for Proportion of Adjudications by PSS Implementation

PSS Implementation

	Pre-PSS				Post-PSS			
	Proportion of Adjudications				Proportion of Adjudications			
Site	Mean	SD	SEM	Time Points	Mean	SD	SEM	Time Points
1	-	-	-	-	.064	.014	.002	57
2†	.089	.010	.002	21	.081	.026	.003	75
3	-	-	-	-	.080	.026	.003	57
4†	.605	.091	.019	23	.372	.231	.027	72
5	.064	.039	.020	4	.052	.020	.003	53
6	.094	.016	.007	5	.087	.025	.004	52
7	-	-	-	-	.109	.021	.004	33
8	.081	.012	.005	5	.085	.027	.004	52
9†	.203	.070	.011	38	.131	.032	.008	15
10†	.082	.024	.004	40	.088	.025	.004	32
11†	.028	.008	.002	26	.035	.008	.001	31
12	.108	.029	.004	52	.126	.029	.013	5
13	.104	.030	.003	94	-	-	-	-
Overall	.146	.167	.053	31	.109	.087	.050	45

Note. Adjudications as a proportion of the prison population at the site; SD = Standard Deviation, SEM = Standard Error of Mean; Time Points are number of months with data; † Sites in post-hoc sensitivity analysis sub-sample.

Table 3

Fixed and Random Parts of Model Predicting Proportion of Adjudications (population adjusted)

Parameter	Estimate (standard error)
Fixed Effects	
Intercept	-2.006 (.2607)***
Time point	-.0048 (.0025)
PSS	-.4938 (.1303)***
Time point * PSS	.0082 (.0024)**
Random Effects (covariance parameters)	
Repeated Measures	
AR1 diagonal	.1251 (.0080)***
AR1 rho	.3807 (.0372)***
Intercept + Time point	
[Subject = Prison site]	
Var (Intercept)	.7436 (.3176)*
Cov (Time point, Intercept)	-.0014 (.0018)
Var (Time point)	1.89E-05 (1.72E-05)

Note. PSS = Prisoner Self-Service kiosks

*** *p*<.001   ** *p*<.01   * *p*<.05

Table 4

Frequency of PSS Functions Usage and Log-ons per week

	Main Wing		
	($N_{prisoners}=76$)		
	Time 1	Time 2	Change (%)
Function	n	n	n
Account Balance	1405	1604	14.16
Prison Shop	409	511	24.94
Top-up Phones	409	511	24.94
FAQs	8	121	1412.50
Messages	56	77	37.50
Noticeboard	695	284	59.14
Surveys	13	21	61.54
Timetable	202	286	41.58
Log-on Total	1699	1785	5.06
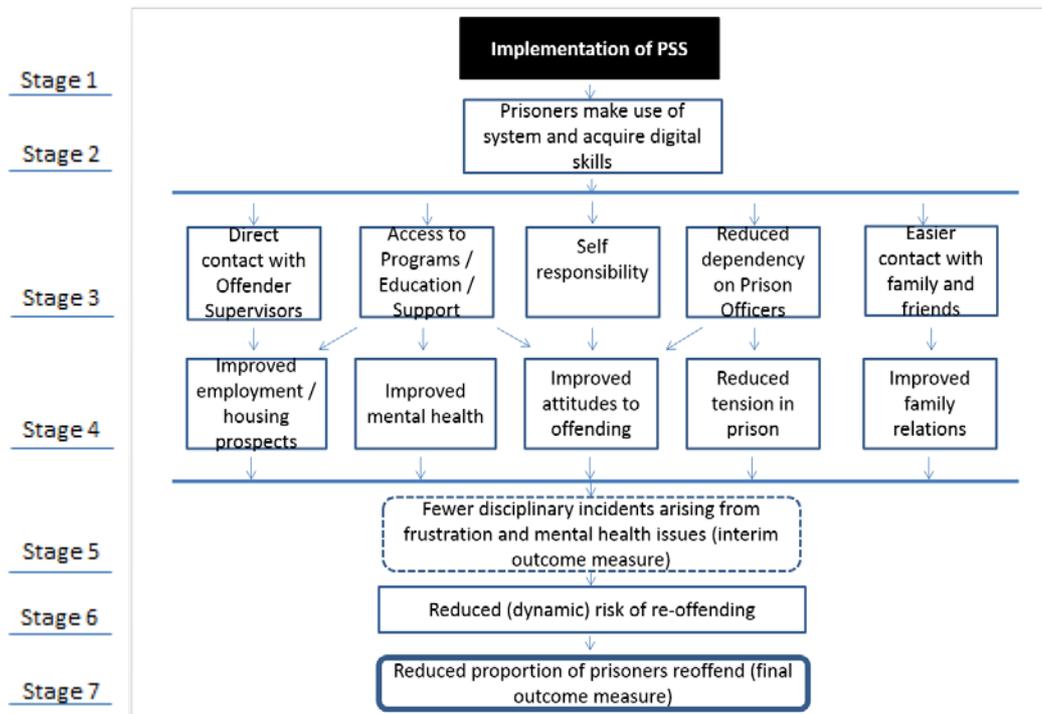
Figure 1. Theory of Change for Prisoners
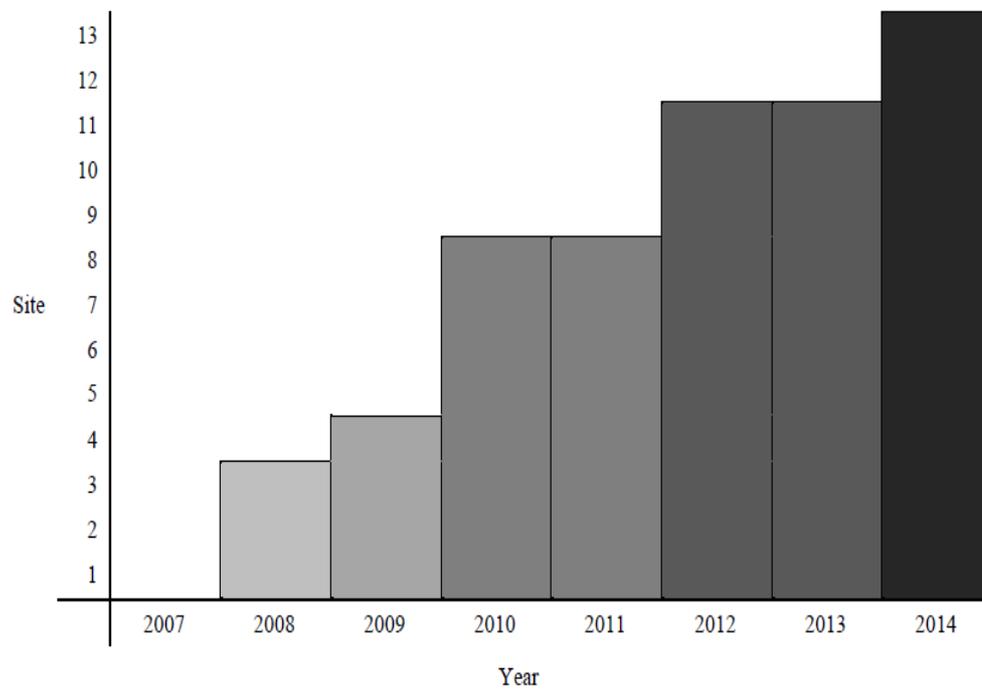
Figure 2. Overview of time period of PSS implementation by site
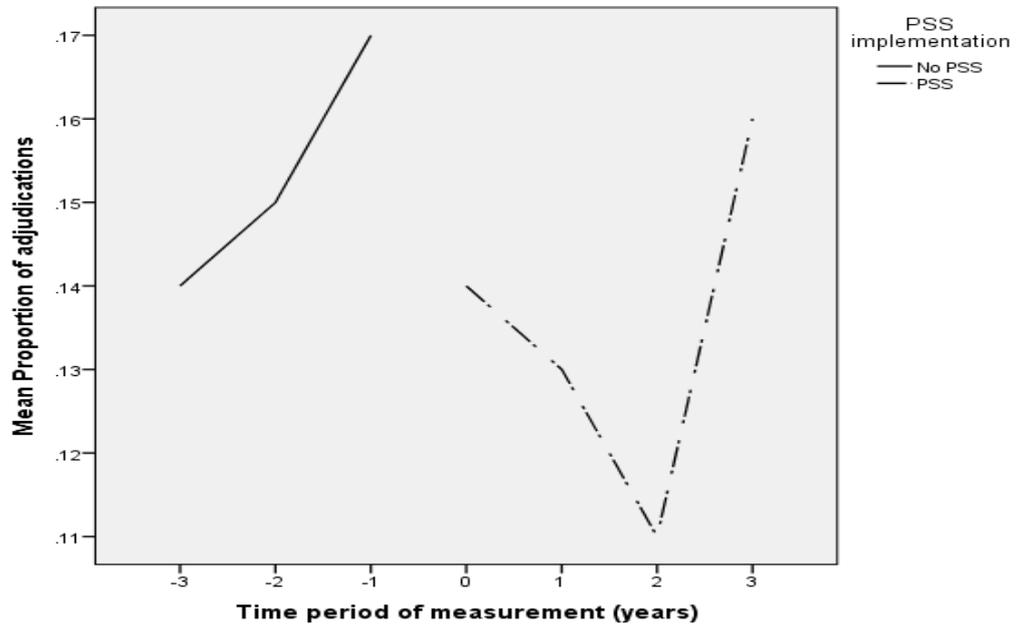
Figure 3. Population-adjusted proportion of adjudications among sites with pre-
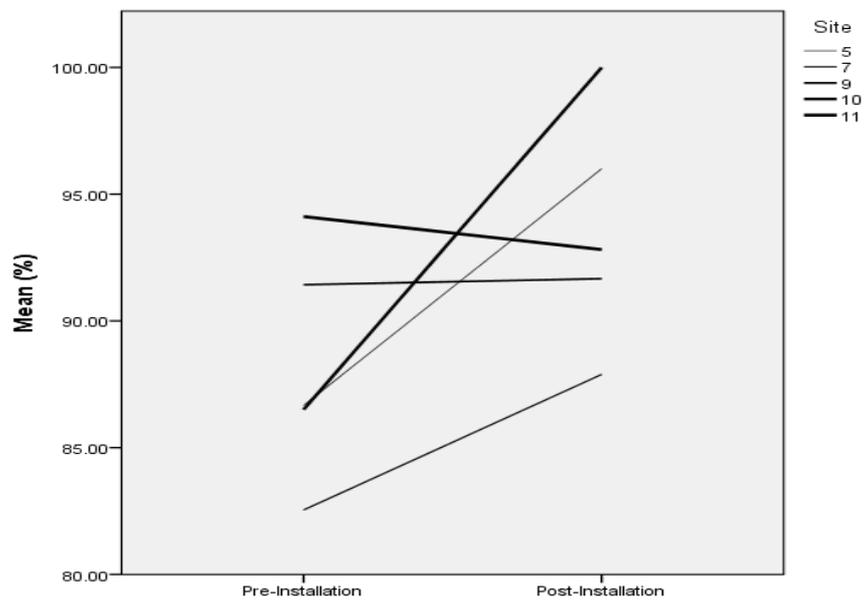
and post-PSS means (*N*=10)

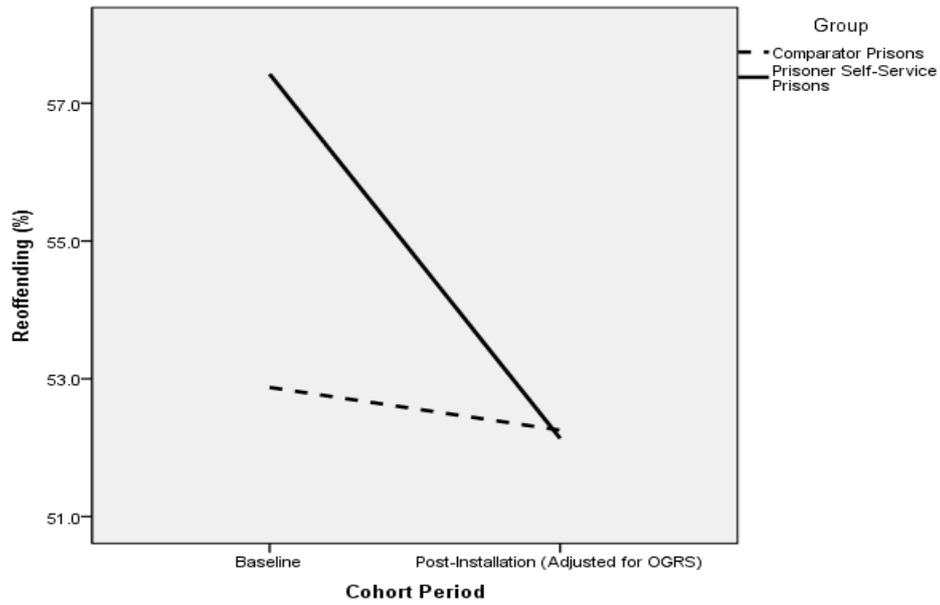*Figure 4.* Proportion of completers relative to starters before and after PSS

installation

Figure 5. Summary of change in reoffending compared to the national trend